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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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BRIEFLY TOLD.

MR. E. G. COWDERY'S MENU.—Mr. E. G. Cowdery "sailed away" from the offing of the Laclede Gas Light Company, of St. Louis, Mo., during the turbulent close of last month, and straightway made haven in the port of Chicago, on the Great Lake, where Bussees are never done, reaching the Auditorium docks in due time. All of which means that Mr. Cowdery having resigned from the Laclede Company to take charge of the Peoples Company, had to be properly manifested from St. Louis. The main feature in the bill of lading was a dinner tendered to him the night of the 19th ult., by several of the consigners, on which occasion gustatory joys were moderated with rhythm, tempered by reason, delivered in wit and seasoned with good fellowship. Perhaps the *carte du matin* will best tell the better part of the story. Here it is:

Estimated Consumption, Tuesday Evening, March 19th, 1907, at the Retort House, Jefferson Hotel Station, St. Louis, Mo.—Stock List of Stoves and Supplies Available for Maintenance and Rehabilitation. Authorized by E. G. C.

High Pressure Booster.
Steam for Generating Fuel.
Bivalves, a la Laclede.
H_2N Consomme.
Welsbach Mantles. Naphthaline Balls.
Spent Oxide and Lava Tips.
Baked Retorts.
Revivification Process *in Situ*.
(Recommended by MM. D. G. F. & S. F.)
Stud Bolts Plugged.

Miscellaneous Supplies.

High Pressure Services.
(Recommended by all Users.)
Concrete.
High Pressure Clamps.
Station A Grout. Spikes.
Assorted Briquettes. Benzole, 90 Per Cent.
Final Complaints.

The menu cover carried a strikingly faithful likeness of the voyager, to whom all wished good sailing and a smooth harbor.

REMEMBERING MR. J. M. ROBB.—"When it became officially known that Mr. J. M. Robb, first Secretary of the Illinois Gas Association, was to retire from the dual position of Secretary and Treasurer to the Peoria (Ills.) Gas and Electric Company, in order to take over the management of the Chattanooga (Tenn.) Gas Company, the employees secretly instituted measures to watch him. Their observation finally led them to ask him to visit the works' office the afternoon of the 30th ult., and when they 'had him right' Mr. Otto H. Bernd stepped out of the group, and, in a speech that brought blushes to the retiring Secretary-Treasurer's cheeks, presented him with a handsome gold time marker, to which was appended a jewelled fob. With consummate tact Mr. Robb safely stowed the token where robbers had small chance of reaching it, but when it came to acknowledging the reminder of the esteem in which his former men held him, the recipient was not nearly as regular in his speech as the watch was in ticking the seconds. However, his acknowledgment was right from his inner self, and I make no error in saying that he was affected much by the speech of Mr. Bernd and the attitude of his men. While we regret that he leaves us we rejoice that his going means advancement for him.—V. R."

CURRENT COMMENT.—

MESSRS. JONES & HOVEY, of Independence, Ia., have again taken over the gas plant at Creston, Ia., and will operate the same on their own account. Captain J. W. Stratton will continue to act as Manager.

MR. J. A. MAYERS informs us that the Consumers Gas and Fuel Company, of Atlantic City, N. J., has awarded a contract to the Gas Machinery Company, of Cleveland, O., under which the latter is to erect on the former's works one 10-foot and one 7-foot 6 inch set of the Machinery Company's standard water gas apparatus. The contract

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includes every necessary accessory to the construction of a complete working plant.

So rapid has been the development of the business of the Wildwood, Anglesea and Holly Beach Gas Company, the headquarters of which are in the last named place, that its proprietors have authorized the Gas Machinery Company to put in an adequate standard water gas generating system. The contract includes capacious purifiers.

MR. AUGUST COURT, Secretary and Treasurer of the Gas Bench Construction Company, of St. Louis, Mo., informs us that recent contracts on its books include the following: Two benches for Sherman, Tex.; two for Salina, Kas.; one for Macon, Ga., and one for Smyrna, Del. The Company is also under contract to forward water gas linings for new sets at Detroit, Mich., and Wildwood, N. J.

MR. WILLIAM A. BROWN, who succeeds Mr. J. M. Robb as Secretary-Treasurer of the Peoria (Ills.) Gas Company, reported for duty the 1st inst. He looks from this viewpoint as the right man in the right place.

MR. JAMES B. KUNKLE, of the office force of the Allentown (Pa.) Gas Company, died at his home in Allentown the morning of the 29th ult. He was in his 23d year having been born in Allentown, March 25th, 1885. He was a young man of much promise.

THE Company at Fredonia, N. Y., is now operated by the Western New York Construction Company.

THE proprietors of the gas plant at Mendota, Ills., have arranged for the extension of its main system to the outlying district of Plano. This likely means that Leland and Earlsville will also be hooked up. It looks a paying plan.

THE celebrated Edward W. Bemis, whose efforts to extirpate gas monopolies have brought fame and fees, is suing the city of Peoria, Ills., for $1,000, which he asserts was earned in the service of Peoria when the authorities of that alcoholic spot were endeavoring to put the Peoria Gas Company out of business.

NEWPORT, VT., at the annual meeting, voted in favor of the following article: "To see if the village will elect a committee to investigate the installing of a gas plant by some gas company for municipal and private lighting and heating, and report at a special meeting."

THE plant of the Sault Ste Marie (Mich.) Gas Company has been successfully completed. Gas was put on the town the last week in March; and it is an absolute fact that the Company's office is the show place of the city.

THE incorporators of the proposed East Pennsboro (Pa.) Gas Company are Messrs. Naudain Hamilton, Donald C. Haldeman, Christian W. Lynch and Wm. Jennings, of Harrisburg, Pa., and Albert Heard, of Hagerstown, Md. This concern has a very ambitious scheme behind it; in fact, it covers a plan to supply a score or more of villages in the lower end of the Cumberland Valley. The people behind it are of the right sort, too.

THE United Gas Improvement Company is under contract to put in an additional water gas set on the plant of the Consoldated Gas Company, at Long Branch, N. J.

A VERY clear section of the measure recently introduced in the Massachusetts Legislature by Representative Joseph Walker is that which reads: "The purchasing or consolidating company may, subject to the provisions of Section 24 of Chapter 109 of the Revised Laws, increase its capital stock and issue bonds to an amount necessary for the purpose authorized in Section 1 hereof, and may exchange its securities for those of the selling or merging company or companies if the aggregate amount of the capital stock and the aggregate amount of the debts of the two or more contracting companies shall not by reason of such purchase or sale or consolidation be increased."

MR. ARTHUR L. WOOLLEN has removed his New York offices from 49 Broad-Exchange Building to 42 Pine street. The offices of the American Standard Composition Company and of Mr. Frank E. Woollen have been similarly removed.

MR. J. G. EHRNFIELD has assumed his new post of Superintendent of the Fayette County (Pa.) Gas Company, succeeding Mr. J. W. Reeser, the latter gentleman having been appointed Superintendent of the Company at Johnstown, Pa.

WRITE to Mr. Charles M. Cohn, Secretary and Treasurer of the Consolidated Gas, Electric Light and Power Company, of Baltimore, Md., for its catalogue of gas appliances. It is a beauty.

[OFFICIAL REPORT, AS FURNISHED BY THE SECRETARY.—CONTINUED FROM PAGE 536.]

THIRTY-SEVENTH ANNUAL MEETING, NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

HELD AT YOUNG'S HOTEL, BOSTON, MASS., FEB. 20 AND 21, 1907.

SECOND DAY, MORNING SESSION.

The President—The next paper, gentlemen, will be one by Mr. D F. Burritt, Superintendent of the Springfield Gas Light Company, on

METHODS OF REMOVING NAPHTHALINE FROM A 16-INCH PIPE.

I have been asked to take a few moments of your time to tell you of our experience, last fall at Springfield, in cleaning naphthaline out of a 16-inch main on Water street, which connects the gas works with the holders, ¼ mile away.

This pipe, which was laid in 1884, has been used since that time to pass the gas from the works to the holders, and has been used under a pressure of from 8 inches to 22 inches. The pipe starts at the works with a covering of about 7 feet, and rises to a point where the covering is only 30 inches. The naphthaline deposit in it has been accumulating for years, and it finally came to a point last fall where we had to take it out by mechanical means, although during the past 2 or 3 years we have managed to reach it quite a distance from the terminals with steam, and thus keep the back pressure down somewhat. On cutting into the pipe we found that which we had already seen when tapping it for testing purposes; *i. e.*, a solid naphthaline deposit around the inside of the pipe with a perfectly round hole in the center, measuring in some places only 7¾ inches in diameter.

The pipe was divided into sections 150 feet long, where holes were dug, and in each hole a piece of the pipe was cut out, beginning from a bell and cutting out a piece about 4 feet long. Rods were then put through the pipe from one hole to another, a lead rope drawn through, and a bundle of heavy chains with a number of hooks attached was drawn back and forth through the section until the whole mass became well loosened. A round plunger of wrought iron, riveted in stovepipe fashion, with both ends open, and about 15 inches in diameter and 3½ feet long, to which a heavy bale was fastened at each end, was then started through, and a pair of horses attached to the lead rope. This had a tendency to cut nearly all of the deposit off and allow some of it to pass through the center of the plunger, thus relieving somewhat the pressure in front. This was the hard part of the operation, as the plunger would become clogged a number of times while dragging a section, and would have to be pulled back with the tail rope for a new start. If it stuck so fast that the horses could not pull it, it was pulled back about 10 feet, and a 2-inch hose from a nearby hydrant turned into the pipe for a few minutes. Generally that would help to loosen the naphthaline at the point of stoppage, so that the plunger would at last come through at the opposite end, moving before it a large mass of naphthaline, and having completely broken down the formation inside. The plunger was then lagged with a ½-inch rope, which was passed around it in half-hitches from one end to the other, the inside front part of the plunger being stopped with a strong canvas bag filled with a substance that would resist the pressure of the naphthaline, and this was again started back through the pipe. This time the rope that was wound around the plunger completely filled the pipe and cut the naphthaline perfectly clean. All of the larger pieces remaining were brought forward, because they could not get through the plunger, and nothing was left but a little finely-powdered naphthaline on the bottom of the pipe. The 2-inch hose was then turned on at the upper end of the pipe and the hydrant valve opened wide. This flushed out all of the loose naphthaline on the bottom of the pipe, and the water was allowed to run until the lower end of the pipe showed clear water coming through. Mirrors were then used to look through the pipe to see if it was perfectly clean, a short bell and spigot piece, with a sleeve, was used to connect the two ends of the sections already cleaned, and the workmen went forward to the next section. In this way we cleaned from 300 feet to 450 feet per day.

Discussion.

The President—An interesting as well as a novel way of meeting a condition and mastering it. If there are any questions or any additions to be made to what has been said we shall be very glad to hear them now.

Mr. Hevins—I would like to inquire, Mr. President, what method he had for by-passing the gas (if he had a by-pass) while this work was in the course of construction, of cleaning out the pipes.

Mr. Burritt—I would say in that connection we had a method of by-passing our make to the city mains and putting the burn on a smaller holder, which gave us a city pressure on the burn, or connected with the city mains at the lower yard, where the holders are. In this way we were able to have this high pressure pipe entirely at our disposal for 6 or 8 hours each day.

Mr. Allen—I would like to ask if they had any means of testing that pipe, say every block or so, before the trouble, and what their system of testing was?

Mr. Burritt—I would say that our system of testing the pipe to find out where the trouble was, and where the back pressure in the pipe really lay, was by putting on the Bristol recording pressure gauges 400 or 500 feet apart. I think they were 500-foot sections. We maintained those on the pipe for a number of days and took careful observations of them. Of course, the dials give us the record, and from that we were able to tell where most of the deposit was.

Mr. V. K. Gould—Was there any difference in the hardness of the deposit as the distance from the works increased?

Mr. Burritt—I think not. It was fairly uniform. All of the deposit was, of course, hard. It was the result of a long accumulation, and, of course, naphthaline deposits under that condition are at their maximum as far as solidity is concerned. The distance from the works seemed to make very little difference in the density of the deposit. I cannot say that there was any difference from start to finish in regard to that.

ANOTHER QUESTION.

The President—The Secretary might read a question on the subject of naphthaline that could be discussed in connection with the paper.

The Secretary—

"Who is making satisfactory use of anthracene oil for doing away with naphthaline? How is it used? Where can it be purchased at the lowest price?"

In that connection I might say here is an extract from some ancient history:

"At the new works of the Consolidated Gas Company, of New York, Astoria plant, naphthaline purification has been attempted. In this instance they have introduced both naphthaline and cyanogen purification. Naphthaline extraction is accomplished by the use of anthracene oil. The latter is a product obtained in the distillation of tar at a temperature of 270° F. There should be no difficulty in obtaining these oils from the distilleries. Anthracene absorbs naphthaline to the extent of 40 per cent. of its own weight, and therefore is very effective in the elimination of naphthaline. The consumption of anthracene is about ½ pound per 1,000 cubic feet of gas."

The President—Is Mr. Addicks here? Is there a report from the New York Company that would throw light on the use of anthracene oil in connection with holding or retaining naphthaline? Is Mr. Klumpp with us? We should like to hear from you, Mr. Klumpp.

Mr. Klumpp—I have no recent experience in this line of work with our Company. I believe considerable work has been done in the last couple of years, but being away from the office I am not sufficiently acquainted with the results to express an opinion.

The President—Mr. Prichard, can you, from your experience in visiting the works there, have anything to say in connection with the results they are obtaining?

Mr. Prichard—I might say I was in the Astoria works last Friday and those machines were erected, but, as I understood, it were not in operation. The tanks were being riveted together.

Mr. Barnum—I should like to ask Mr. Prichard at what point these mains were placed.

Mr. Prichard—I have it not very definitely in my mind so that I can speak with certainty, but my remembrance is that they were placed preceding the standard ammonia washer.

Mr. Barnum—Right after the cyanogen scrubbers?

Mr. Prichard—Yes; these were in the same room, and both pieces of apparatus (the cyanogen and the naphthaline) preceded the ammonia washer. Just which was which I don't know.

The President—Has Capt. McKay any light to throw on this use of anthracene oil?

Capt. McKay—No, Mr. President.

The President—Mr. Fowler, I am afraid all has been said in connection with the subject.

Mr. Klumpp—I forgot to mention that I was in England some time this year and found that an oil for scrubbing was being used for naphthaline over there, but I have nothing to say of my own experience in this country. But Mr. Colson, of Leicester, has put on the market a naphthaline oil, as he calls it, which is an anthracene oil obtained from his distillation of tar, and it has been adopted by several of the larger cities. It has greatly reduced the Sheffield Gas Company's complaints on the naphthaline question in the last two years, and Mr. Colson also, at Leicester, has gotten rid of much of his naphthaline troubles. This naphthaline oil is used in a rectangular Livesey washer through which the gas passes.

The President—Does it affect the candle power?

Mr. Klumpp—Apparently not.

The President—As regards cost?

Mr. Klumpp—I could get no cost from him.

The President—It is a cheap oil, I presume?

Mr. Klumpp—Yes. He is charging about three times as much as it is worth, I suppose, for other purposes, but as it is applicable for this use he sells it in small quantities and gets his price.

Mr. Macmun—I will ask the question if that oil is not used in this country in the holders?

Mr. W. A. Learned—Do you mean by the Quinn method?

The President—Mr. Quinn, Mr. Macmun would like you to answer that question.

Mr. Quinn—What question is it?

The President—Whether or not you have made use of oil for preventing or eliminating naphthaline.

Mr. Quinn—Well, this year I have not got any naphthaline. I will say, gentlemen, in addition, that the only part of my works where I have naphthaline is at the inlet of the holder. This fall or summer I have been making some experiments as to the absorption of the moisture in the meter by the dry gas, and I find by shutting off the outlet of the meter and supplying the moisture taken up by the gas with oil, that it will absorb about 5 gallons of moisture for about 4,000,000 feet of gas; or, in other words, after 4,000,000 feet of gas has passed the meter I put in 5 gallons of oil. The water line of the meter goes down just about 5 gallons with that amount of water. When that moisture is taken up by the gas I have a little naphthaline in the inlet of the holder, and that is the only place in my works that I have naphthaline. I think for about 16 months I have used the oil in the holder. In that 16 months I have opened my governor about 15 times, and not a grain or a crystal of naphthaline showed in that governor. The naphthaline in the streets has disappeared entirely, except that probably there is some leakage in our service pipes, where the water gets into the main and flows down the drips. After the gas has passed into that water, I think it has taken up some of the water, and gets into some other place where the water is condensed out of the gas, and naphthaline forms at that place. My judgment is limited to the form of our works. Out of our 4,000 consumers we have not had 10 complaints a day of naphthaline or any other trouble. This year has been a very remarkable one for sudden drops of temperature. In previous years I have had more or less frost, services plugged up, services stopped up by frost. This year I have not had one, which I think is due entirely to the oil in holder and keeping the gas perfectly dry.

The President—The Lord certainly does love Newport.

Mr. Quinn—Sure.

The President—I wish we all could tell the same story.

Mr. W. A. Learned—I move a vote of thanks to Mr. Burritt for his paper. [Seconded.]

The President—Gentlemen, you have heard the motion, that a vote of thanks be extended to Mr. Burritt, of Springfield, for his paper on naphthaline. [Adopted.] The vote of thanks, Mr. Burritt, is conveyed to you. It is too bad that Mr. Addicks appeared on the scene after the discussion had closed on the anthracene oil and naphthaline question. Is there anything he would care to say regarding it?

Mr. Addicks—Mr. President, I think we will say more about that next year.

The President—Mr. Fowler has a paper that will give the members pleasure to listen to.

Mr. S J. Fowler, of Springfield, Mass., then read the following paper explaining

DIAGRAM COVERING FIFTEEN YEARS IN THE BUSINESS.

The accompanying diagram was made to show the changes which have come upon our business during the 15 years covered. In 1890 the use of gas was confined almost exclusively to illuminating, whereas now the quantity used as fuel is extremely large, though generally we cannot tell exactly what its amount may be.

This diagram shows the percentage which each individual month bore to the total output in the years 1889, 1890, 1899, 1900, 1904 and 1905, beginning July 1 and ending June 30. It was necessary to include in the chart the percentage from 4 to 14; therefore, you will see that the figures run from 1 to 15. These figures overlap, but I hope

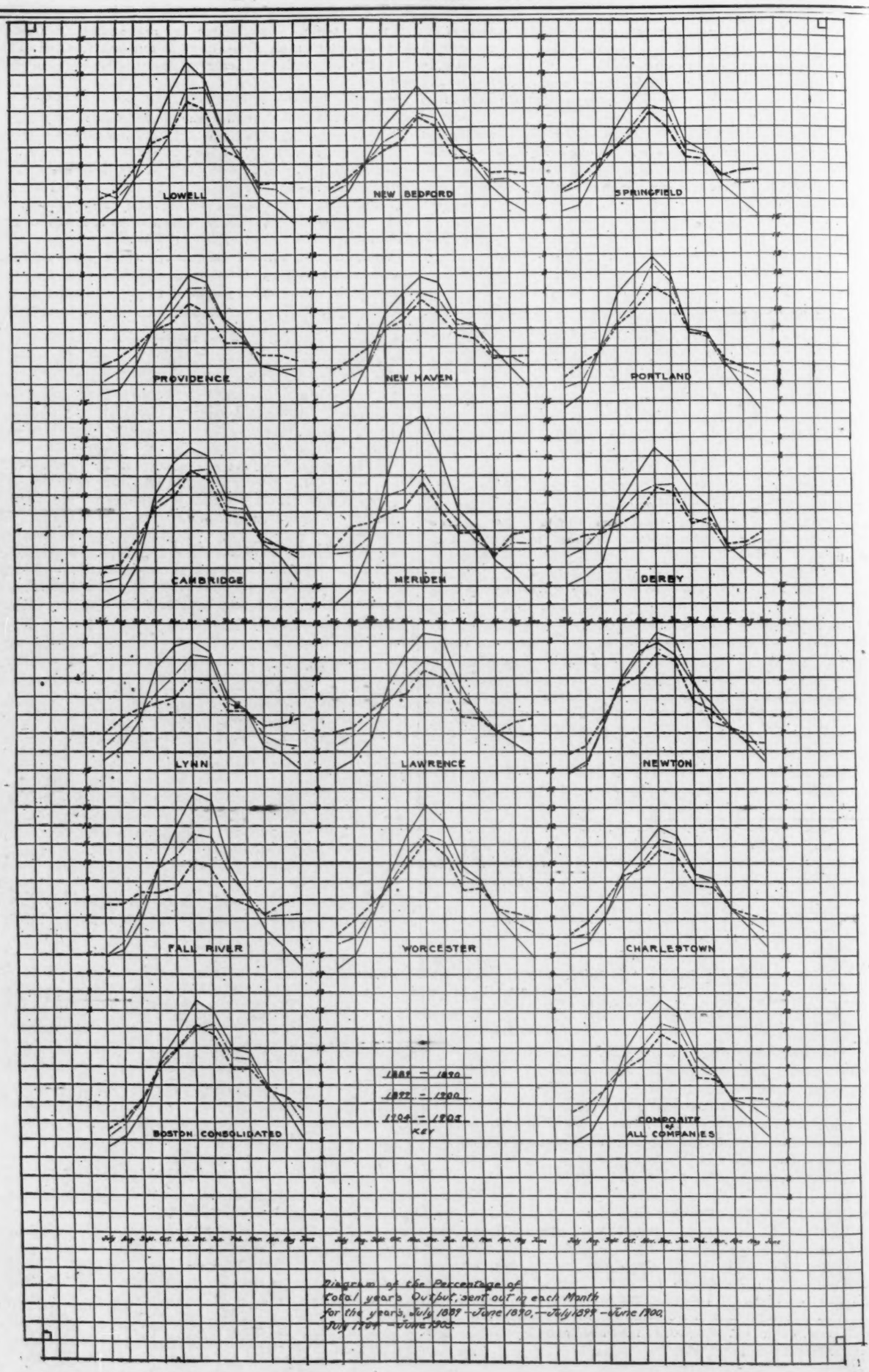


Diagram of the Percentage of Total years Output, sent out in each Month for the years, July 1889 – June 1890, – July 1899 – June 1900, July 1905 – June 1906.

you will all understand which sets of figures apply to each separate diagram.

There is not very much to be said concerning the various companies whose names are given. Local circumstances have to a large extent influenced the development of each, and special circumstances have sometimes affected the chart for the particular year. For instance, a strike during the winter of 1904–1905 had a great effect in reducing the percentage of winter output in one of our manufacturing cities and makes the chart of the year much flatter than it would naturally be. The composite chart of all the companies tells the story of the changes. The table of percentages is as follows:

	1899-1890.	1899-1900.	1904-1905.
July.....	4 9	5 9	6.6
August.....	5.5	6.2	7.1
September...	7.0	8.2	7.9
October.....	10.0	9.3	8.9
November..	11.5	10.1	6.5
December....	12.5	11.3	10.7
January.....	11.9	11.0	10.2
February....	9.7	9.3	8 5
March.....	8.8	8.6	8.4
April.....	7.1	7.2	7.4
May	6.1	7.0	7.4
June	5.3	6.2	7.3

During the first period the output in July was about 40 per cent. of that in December. In 10 years it had risen to over 50 per cent., and in the last period it is over 60 per cent, which means that the works, the mains and the meters are worked during the summer at an efficiency 50 per cent. greater than 15 years ago. This reduces the capital necessary per 1,000 feet of yearly make, and is probably one of the main reasons that the companies have been able to reduce prices so largely even though costs of materials have remained on the whole substantially unaltered.

According to the report of the State Gas Commissioners of Massachusetts, in which State most of the companies mentioned are contained, the average price of gas during the first year we are considering was $1.46, the second year $1.10 and the last year $1.02. In 1889–1890 the companies got more than 40 per cent. more for their gas than they did in 1904–1905, and 50 per cent more than they are getting now.

All things considered, I believe that gas is sold in this neighborhood at as low a price as anywhere in the world. The New England companies, being at a distance of 500 miles or more from the coal and oil fields, ought not to be expected to furnish gas at as low a price as companies more favorably situated; and still (such is our altruistic devotion to our fellow citizens) there are few sections of this country where the price of gas is lower.

Discussion.

The President—Gentlemen, we have listened to a very interesting feature of the business. Are there any questions that you would like to ask Mr. Fowler? If so, the opportunity is extended for so doing. Hearing none, we will proceed to another matter of business with the Secretary.

[It was moved and seconded that a vote of thanks be tendered to Mr. Fowler for his contribution, which motion was adopted.]

The President—Mr. Fowler, I take pleasure in conveying the thanks of the Association. The Secretary has a letter here which he will read.

The Secretary—A communicated article came in this morning. It has an exhibit with it which perhaps you will like to look at after the meeting. It is entitled:

FIRE EXTINGUISHING EQUIPMENT IN GAS WORKS,

and is by Mr. E. H. Yorke, of Portland, Me.

It must be admitted it is somewhat anomalous that, in the majority of gas works, but scant provision has been made for extinguishing fires. The reason for this failure to recognize and provide for a contingency liable to arise at any moment cannot readily be determined. That fires seldom occur in gas works cannot logically be offered as an argument against not being prepared to meet the contingency of a fire and be in a position to reduce the loss and disturbance of the plant to a minimum. It must, however, be conceded that the demands on the gas works superintendent's time are so constant and multitudinous that it is not to be wondered some things escape his serious consideration, and the writer, therefore, feels that for this reason he is in order in calling special attention to the subject and referring in a general way to some important points in relation thereto. That "prevention is better than cure" is generally accepted as a true axiom. The elimination, then, of fire risks in every way possible is most desirable, some of which may be mentioned as follows:

(a) The location of oil tanks in as isolated position as possible.

(b) The elimination of all furred, lathed and plastered walls.

(c) The use of inclosed electric lights in all buildings where seals may blow.

(d) The use of safety waste cans.

In equipment for fighting fires, the Underwriters' Extinguisher should be in readiness for use in all parts of the works. Fire hydrants and hose, in such locations as will permit every part of the works to be reached, should be established.

The writer begs to submit the fire regulations of the works immediately under charge, which may possibly offer some suggestions to other superintendents who may desire to formulate some regulations for their own works.

While fully realizing that the writer is not offering much herein that is new, he still feels that the importance of the subject amply justifies his presentation of it to the members of the Association.

The President—Gentlemen, Mr. Yorke succeeds in keeping the heats down. Most of us want to keep our heats up in certain parts of the work. I don't know that there is anything to say. Mr. Yorke unfortunately is under the weather and is not here to answer any questions, but the card suggests its own answer to any natural inquiry. In that connection the Secretary might read the question on protection of oil tank.

The Secretary—

> "In case the oil tanks are closely adjacent to a river or tide water—say within 100 feet—should some precaution be taken to prevent the oil from a disrupted tank flowing into it with the probable ensuing conflagration? Has anyone used a moat? Is it feasible or advisable?"

The President—Now, gentlemen, I understand in Massachusetts there are laws governing that sort of thing. This question was asked by a man that had a situation on his hands. He was situated about 100 feet from the river, and was fearful that in case the tank broke he would have trouble. Capt. McKay, what have you got to say of proper protection to oil tanks?

Capt. McKay—The most efficient protection is given by putting the tank partly down in the ground, not so deep as to interfere with the suction by the depth, then incasing it with concrete or dirt, and finally covering over the top with a layer of water. We cannot always afford to do all these things, but we can all of us do some of them. Some of the largest and best installations are cared for in this way.

The President—Any other information, gentlemen, we shall be glad to have.

Mr. Wyant—All our tanks in New Haven are protected by a moat of some sort. In the case of one set there are two tanks inclosed in a brick pit, and in the case of two other and much larger tanks we have a surrounding concrete wall, 3 feet larger in radius and high enough to prevent any oil escaping in case the steel tanks were full when a break should occur.

Mr. Barnum—I would like to ask if there is anyone present who can tell us the method that the Standard Oil Company use for protecting their tanks from being struck by lightning. They have a method which I understand is quite efficient.

The President—Is Mr. Coburn in the room? Not hearing from him, anyone familiar with the protecting features used by the Standard Oil Company we will gladly hear from. Possibly some of you New York men that live adjacent can tell us.

A Member—Mr. Gifford lives close by them.

The President—Do you know what preventives they use?

The Secretary—They build a wall around their tanks; that is, where they have several tanks in a bunch they build a wall high enough and inclosing space enough, I suppose, to prevent the oil from escaping outside of this wall in case it should break loose.

A Member—Lightning protection?

The Secretary—I am told by the Standard Oil people that they never have any trouble with lightning in anything but crude oil tanks. I hope they don't keep any crude oil next to us to be struck by lightning. As far as I know, there is no provision.

Mr. Addicks—What is to be said about venting the tank? I should be glad to hear something about that feature of it.

The Secretary—At one time I connected up a very elaborate vent from the oil tank to the gas main, I think the water gas connection, and supposed it was all right until one time they attempted to fill the tank without giving it any other vent, and found that that pipe was filled up with tar; the crude gas had evidently been drawn back into the tank and the vent was useless. I don't know why, if it was kept free, it

could not be vented into some gas piping, so that there would be no loss and there would be a vent.

Mr. Addicks—If I remember correctly, years ago at the Bay State there was a method of using No. 60 wire gauze, or something of the kind, in all the vents. I would like to know from Capt. McKay whether that is still continued?

The President—We should like to hear from the Captain.

Mr. Addicks—I have a purpose in asking the question.

Capt. McKay—I think you can get that more exactly from Mr. Cheney.

The President—Mr. Cheney.

Mr. Cheney—We use the wire gauze as Mr. Addicks said. That is about all. The only vent, if I remember rightly, is a 4-inch pipe, with a double elbow, one leading down to a flange union with a piece of wire gauze in it.

Mr. Addicks—The point of my question is this: Within my knowledge a certain tank of a very large size had four vents with that wire gauze. Then experience shows the absolute necessity that the wire gauze should be kept clean.

Mr. Klumpp—It has been the custom with the United Gas Improvement Company to ventilate a great many of its oil tanks by connecting a 2 or 3-inch line to an inlet or outlet of the relief holder, and at the same time to put an oil seal of 10 or 12 inches on some other part of the surface of the top of the tank. This is in case the pipe to the holder inlet pipe should become clogged, no excessive pressure could get on the tank without blowing the oil seal. This installation has been tried in a good many cases and found successful, and was done principally when the lighter volatile oils were used, but the practice now, with the use of the heavy or non-volatile oils, is to have a vent with double elbows looking downward containing a fine wire gauze. All the oil tanks when built are surrounded by a brick or concrete pit that will hold the entire contents of the tank in case it should rupture. That is done in every case, so that we have had no very serious accidents by the breaking of a tank and flooding the works. Where it is possible, oil tanks are placed at lowest and isolated points where rupture or leakage would cause least damage. Many oil tanks are built with 6-inch water top to hold water, which is quite efficacious as a protection in some cases of danger.

Mr. A. J. Campbell—Mr. President, while I did not send the question to the question box, I did write asking the question of quite a number of engineers. Some of them were members of this Association, and some were outside of the district. While I have thanked them all individually, I want to make this public acknowledgment of the very full and courteous replies that I received. I was very much interested to note that the replies—and they were all from engineers who were competent to speak on the subject—grouped themselves into two groups. One set of men thought it was better to put the tanks above the ground, and not to make any attempt to catch the oil in case of accident, basing their position on the fact that in their experience, as far as they had known or heard, nothing had ever happened, rather admitting, however, that if anything should happen they had made no provision against it. The other group of men, of about the same number, said that while they had not known or heard that anything had ever happened from putting an oil tank above the ground and having the contents spill out, in their opinion the possible consequences of the rupture of an oil tank where the oil could catch fire and spread over a river or harbor, were so terrible that they thought it better to build a moat of some kind around the tank. It seems to me, therefore, that it comes down in any particular case to weighing the possibilities of the consequences in case of a rupture against the very small risk of that rupture ever occurring. I have not heard, nor had any of my correspondents ever heard, of such an accident. I think the matter was best expressed in one of the replies, and I will read it, although I have not the words exactly as written to me, because I condensed the statement somewhat. It was very nearly as follows: "I have had considerable experience with oil tanks in both this country and abroad. I have seen a number of large capacity without moats, and in dangerous localities, and have never known of any serious mishap resulting. I have seen a large number of tanks surrounded by moats of earth, puddled on the tank side with clay, others surrounded by reinforced concrete moats, others sunk in the ground, the surrounding pit being made tight, and have never known one of these moats to serve a useful purpose. Nevertheless, I am very strongly of the opinion that, where there is a possibility of the tank bursting and spreading the oil on the surface of a harbor, an outside retaining tank should be built, because the damage that might possibly result is so terrific. I think that sums the situation up, and it is for every man to decide in each case whether the risk outweighs the cost of the protection. I might add some little points that are given in the letters. This particular gentleman suggested the use of reinforced concrete in building the moat. So did another. A third man said, in addition, that he had a steam pipe running into the top of the tank, controlled by a valve placed at a distance, so that in case of fire a large quantity of steam could be admitted to smother the fire. Others suggested the use of a water cover, which I think has already been mentioned here to-day. Another gentleman was connected with an oil company—by-the-way, I wrote to several oil companies, and they all recommended the use of a moat. This gentleman recommended the use of a wall of clay covered with sod, because he believes that is better than concrete, as concrete is sure to crack under the influence of heat. He considered a brick wall next best to the use of sod. Several recommended the use of an underground connection from the tank to another tank, if possible, so that, in case of fire, the blaze being on top of the oil, what remaining oil was in the tank could be pumped into the second tank, not only to save the oil, but to make less fuel for the conflagration. One man in mentioning that point said great care should be exercised to see that the pipe or pipes by which these connections were made should be well protected from the fire in case there was a possibility of fire. Another man said: "Do not allow any pipes to run through the yard and on top of the tank. Such pipes frequently accumulate electricity from the air and cause a flash right at the end of the pipe, where it enters the tank. If circumstances require the use of such a pipe it should be carefully insulated." These are little points that were brought out. I think the main question, as to the use of a moat or not, must be decided by each member in his own particular case.

Mr. Addicks—Mr. President, I think the laws of the city would absolutely demand a moat, and I would say to the last speaker that it is within my knowledge that oil has gotten away from a tank, to be sure, but practically all or substantially all the contents of the tank were lost by a rupture in the bottom of the tank. It did not result in a serious accident, but all the elements were there. Anyone putting in a moat will have to provide for a method of pumping the water from the moat; otherwise, when the tank is nearly empty, if the tank connections are above ground, if too much water is allowed to flood the moat the tank will float and break the connections.

Mr. Hevins—I find here a representative of the Gulf Refining Company, Mr. Eisenman, a gentleman with whom I have had a good many pleasant relations. Probably he could throw a little light on this subject, if there are no Standard Oil representatives here.

The President—We shall be glad to hear from Mr. Eisenman on anything touching the question.

Mr. F. N. Eisenman—In the field conditions, with which I am familiar in a limited way, the tankage is invariably provided with earthen moats. In so far as our stations along the Atlantic seaboard are concerned, we follow out the sod proposition that was just suggested. In the matter of lightning, I never heard of any trouble from that cause at any of our storage stations, although in the field troubles from fire more frequently occur. To keep them from spreading the moats are very much more necessary there than they are in the stations; but it is my opinion, from a careful study of the matter, that it is mighty good insurance for a man to surround his storage tank with a moat, if it is above ground.

The President—This is interesting. There is, of course, a possibility. I think it was either at New York or Pittsburgh that within two years a storage tank was struck by lightning and caused considerable damage. Was it in New York, Mr. Addicks?

Mr. Addicks—My impression is that two or three years ago there was a tank struck by lightning, but it is hearsay.

The President—I think that answers fairly well that question. The next question here is:

"The most economical way of enriching coal gas?"

Mr. Prichard, of course, could tell us about the Welsbach light. We call on him a good deal. I think, Brother Learned, we want to hear from you. Nothing? Well, gentlemen, has any person anything to say?

Mr. J. J. Humphreys—There is no doubt whatever. There is only one choice in that matter. The most economical method is the admixture of high candle power water gas. That may not be a satisfactory explanation or the one that the gentleman asking the question wanted, but that is the most economical method.

The President—Capt. McKay always has something brilliant and illuminating.

Capt. McKay—There is one limitation on the use of water gas, in the matter of the size of the works. If it is a small coal gas plant it would be necessary to meet the difficulty in another way.

The President—Mr. Coffin, just the man I had in mind. Mr. Coffin, gentlemen.

Mr. Coffin—I come from a sized works that is not large enough really to run a water gas plant for enriching purposes, so we make an oil gas continuously during the 24 hours. We can run that down to as low as 80 gallons of oil in 24 hours, and from that up to 150. We have been running that for a number of years. When the coal is of average quality we get very fair results. Sometimes we run up against a different proposition, as we often do in this business. There doesn't seem to be any new position in anything; but I would say that usually we have had very good results, that by getting about 75-candle feet to a pound of coal, instead of 85, as we were brought up to expect, and by using two-thirds of a gallon of oil per 1,000 a year, we have been able to maintain practically 17½ or 18-candle gas.

Mr. Addicks—May I ask the same question, and make an addendum to it, with a minimum candle power of 22?

Mr. Wyant—A question came up yesterday as to the relative value of the present coals to the coals that we had been getting heretofore. I have with me a few analyses which may be of interest. In the matter of sulphur, our tests, ranging from 1903 up to the present time, run 1.03, 1, 1.01, 1.14, .95 per cent., and the volatile matter ranges from 35 to 36.6. A test made yesterday shows 1.12 per cent. sulphur, 34.92 per cent. volatile matter, and 9.3 per cent. of ash. In the matter of candle power and enrichment, we enrich the coal gas entirely with water gas, and our average coal gas candle power is 16.3. That, however, is on a tolerably low yield, and I have not the figures with me, although I can recall them very closely. That candle power is based on an average yield of 4.58. Another peculiar thing, which is of some interest, until quite recently we have been testing the unpurified coal gas at the outlet of the rotary scrubber, so that it contained practically the bulk of the sulphureted hydrogen. For the past 4 weeks we have been testing purified coal gas, and since changing the photometer connections the average has been 16.32 candles; for the month previous the tests on the unpurified coal gas were 16.3, the yield being the same in each case.

Mr. Nettleton—Perhaps this is a fitting time to bring forward a matter which I would like very much to speak about for a few moments. Yesterday the question came up as to the quality of the gas coals being shipped into New England as compared with those of previous years, and some statements were made attacking the coal companies as I thought and took exception, but as I did not have any coal analyses with me I did not dare speak. Since then they have been received, and Mr. Wyant has now given you some of the results. For years the companies I am connected with have dealt with only one coal Company, and the relations with that particular Company have been such that I do not want to have go on record that which was said yesterday without a protest. The Company I refer to, as many of you know, has within a few years employed a chemist and erected a testing plant. There are analyses for sulphur going on all the time and also tests for quantity and candle power. They are trying, I believe, to the best of their ability, to send us coal as free from sulphur as their mine will permit, and the analyses that Mr. Wyant has just read you show that for 3 or 4 years the sulphur has been running about the same. I think that must have been the experience of a number of other companies. Now, as to candle power. I hardly think I can say positively that the candle power produced by the coal we are now receiving is any less than that produced from coal carbonized 10 or 20 years ago. Some of you may be able to prove that positively, but it seems to me it is about the same. I say this because I believe it thoroughly, and because I believe it should be said in justice to at least this one particular coal Company.

Mr. Prichard—Mr. President, I suppose I made perhaps the only positive statement that was made yesterday in regard to the sulphur, the candle power and the yield. Those figures I believe to be substantially true. I think it is quite right and proper we should say to the coal companies what we think of their coals, because it gives them an opportunity to know what we think of the coals and to better the conditions. As many of our railroad friends, and we ourselves say, we are glad to have our customers come to us and tell us where we are doing wrong, or where we are not doing as well as we used to, while we may be doing as well as we can. Now, it seems to me that the figures quoted by Mr. Wyant, in which he gives the yield of 4.58 and the candle power of 16.32, corroborate what I said yesterday, that an average yield of coal, such as we get to-day, is substantially 4.75, with a candle power of substantially 16. This in both cases figures out to practically 75 candle feet. I still think that that is not equal to the yields we were getting many years ago. If we can get hold of some of our men who are running smaller works I think you will hear them say it is practically impossible for them to get a 16-candle power yield out of Westmoreland or Penn coal under the conditions in which they are running to-day. Now, why this is so I said yesterday I could not explain. I suppose the probable reason is, and I think it is a legitimate reason, that the companies have so increased their output that they have gone into wider fields, and we do not get the cream of the coal that we got years ago. It is no criticism on them. It is a commercial condition. They cannot get it. They cannot give it to us. We must take poorer grades of coal, as we take poorer grades of oil and various things of that nature. It is not a criticism; it is a simple statement of facts. I would be very glad if some of the gentlemen who are running small works would give us the results of their candle powers and yields as they get them to-day compared with what they got 10 years ago. When we passed the jack knife around in the New England Association 15 years ago, a fellow that did not get fined a quarter on 17-candle gas simply was not in the game.

Mr. Barnum—The figures given by Mr. Wyant in regard to the sulphur correspond very closely with what we are getting in our analyses and have gotten for a number of years. In the question of the candle power and candle feet, as to what we are getting now and have been obtaining in past years, I think that the best average for work of years ago is considered the work that was done in a small plant here in Boston perhaps 20 years ago. These figures were made on different coals. The best results came from coal near Pittsburgh. Those figures gave an average of 5 feet of 15-candle power gas. From hearsay, they were getting much more. Those were figures published by Mr. Lamson, and I think they are in the proceedings of this Association and can be corroborated there. I have heard a great many gentlemen say that they are the authority on gas making of that time.

Mr. C. W. Hinman—Mr. President, a good many years ago I made analyses of some gas coals, and my recollection of the amount of sulphur that I found in the gas coals in general use was something like from ½ of 1 per cent. to 1 per cent. I am speaking entirely from memory, but I am fairly certain of the results.

Mr. Coffin—I am running the same works that I have been for the last 25 years, and I would say that our experience in the last few years—3 or 4—has been that we have had harder work to get 75 candle feet a pound than we used to have to get 80 or more. With regard to the sulphur, our coal was for years guaranteed to us less than 1 per cent., it might be .6, .7 or .8, whereas for the last 3 or 4 years, in 10 or 15 different analyses we have had made, it has run from 1.10 to as high as 1.60, 1.25, 1.40. Our works have increased, of course, somewhat in 25 years. They are about 10 times as large as they were 25 years ago as regards output. It is not a fact that the yields have increased, it is rather a fact that before the last 2 years we used to make 5 feet of gas more easily than we make 4¾ to-day. I hope some of these members round here, instead of kicking about the different coal companies as they do every time that I meet them, will get up here and state just what they are doing at home. I think Mr. Prichard is on the right track. Perhaps the coal companies would be justified, if we do not say anything especially to them, if we acquiesce, in thinking that we are satisfied, and I don't believe they pick their coal any more than they are obliged to to satisfy their customers. Now, it was put up to me a few years ago that we were very small customers of the companies whom we buy coal from, that is, that we took only about ¼ of their product, that ¾ of it went to the steel companies, and they insisted that the coal must have under ½ of 1 per cent. sulphur. The thought occurred to me whether, if they picked theirs so much closer, we got a little more than we used to, and that would account for the increased sulphur that the gas companies get. Being a customer for only about ¼ of their product, the other people would naturally get fully as much attention.

The President—Thank you, Mr. Coffin. Mr. Sargent is a Massachusetts manufacturer, and possibly his experience would be enlightening.

Mr. F. H. Sargent—I think our average yield of coal is about 4.75, but it has been quite a long time now in regard to sulphur that we have had less than 1 per cent. It ranges from 1 per cent. to 1.5.

The President—Mr. Macmun.

Mr. Macmun—I should like to say that in my experience coal does not deteriorate so much as has been mentioned here. I believe that in the past years our merchant qualities have been reduced. Some are using oil. A great many have been making large yields and are to-day, but of a poorer grade.

Mr. Prichard—I am rather anxious to bring out a full discussion on this thing, because we are up against various sorts of troubles in this section of the country, the principal thing being reduction of the price

of gas. I take the position that we are paying more for our materials for making gas, we are paying more for our labor in making gas, but the efficiency of the material we are buying is lowering. If that is the fact, we want it considered; if it is not the fact, I am willing to stand on the facts as they are. If the efficiency of the materials that we are producing has fallen off the gas companies should have credit for it in their efforts to withstand applications for lower prices. If we cannot do as well with our coals, our oils and our labor, as we could 10 years ago, this is an argument why we should keep up prices, and I believe it is a legitimate and proper argument. I am for that reason anxious to have the gentlemen speak who have experience and can give us light on these subjects. It is not in my mind at all criticism on the coal company, any more than it is criticism on the Standard Oil Company, that we cannot get naphthas that we used to get 15 years ago for 4 cents a gallon. We cannot get them now. We have to take a very inferior article and do the very best we can with it. So we must probably take an inferior coal, but if it is so let us acknowledge it fairly and start out on our new basis. I wonder if Mr. Spaulding would give his experience.

Mr. C. S. Spaulding—I am running the same works, under exactly the same conditions, that I have been for 8 years. Prior to 3 years ago I had no trouble whatever in getting a candle power above the standard. I was using at that time less than ½ gallon of oil to the 1,000 feet. For the past 3 years we have been using exactly the same coal; that is, coal from the same people. For the past 3 years I have been using as high as 1¼ gallons—I have gone up to 1½ gallons to the 1,000. It is hard work for me to get 16.5-candle power with a 4.75 yield, using 1 gallon to the 1,000 feet. While I won't say that it is coal particularly, I have tried all kinds of oil and cannel coal, though not to a great extent. I have tried the oil in all ways: Under pressure in a retort, on to the coal at intervals of perhaps 15 or 20 minutes, by rigging up a retort through a series of pipes, running the oil in that way, also using it in cartridges, as you can in small works, and I have come to the conclusion that, with the oil that we are getting to-day, I can get better results from the cartridges than in any other way. I am still having the same trouble. I am using about .9 of a gallon of oil now, getting an average of about 4.70 yield, oil included. I get a candle power averaging anywhere from 16.1, the lowest that I have had this winter, to 16.8, the highest that the State Inspector has witnessed. Previous to this year (2 winters ago) I had more trouble than before. I have tried condensing and scrubbing without water; I have tried it with cold water and with hot. It doesn't seem to make much difference. I can get a little better results with the hot water by keeping the gas warm clear through to the purifiers than I can with cold water. I am not through experimenting with it on the different ways with the water. I am going to try it for a little longer time, and run hotter water than I have been running in my scrubber, getting the gas at the purifiers up to 80° if I can. I have not been able to do it yet.

The President—We are glad to have heard from Mr. Spaulding. Is Mr. Gifford, of New Bedford, in the room?

Mr. C. H. Gifford—Mr. President, I don't know that I have anything particularly to say about the coal.

The President—Your coal you find all right? Better yield than you got 3 years ago?

Mr. C. H. Gifford—Well, we are running now with older benches, so that the yield would naturally fall off a little. I am not prepared to say that the yield is any less than it was 3 years ago.

Mr. Barnum—In connection with figures that I quoted a short time ago I should like to say our average gave us a trifle over 5 feet to the pound, and candle power of 15, which gave us 75 candle feet. This corresponds closely with the figures I quoted. I would like to ask Mr. Prichard what his candle feet is at the present time.

Mr. Prichard—I don't know that I can quote it from mind, but it varies quite a good deal. I wonder if Mr. Anderson remembers what we are getting now.

Mr. Anderson—I would say between 75 and 78 candle feet.

The President—Does that answer your question, Mr. Barnum?

Mr. Barnum—Yes.

The President—Mr. Addicks.

Mr. Addicks—Mr. President, I think this is a very important question. I feel very much as Mr. Prichard does. The Commission in New York State are about establishing standards for purity and candle power. Their report to the Legislature this year states that there is a great variety of candle power in New York State; in fact, I think as low as 8 to 12 candles they found in their preliminary inspection. Now that we have so many "transom" gas engineers it is very important that we have careful methods of comparison. I don't want to talk much about the immediate past, for obvious reasons at the present time. When it is a little further back in the past I might have other things to say. But I will call your attention to this: That nothing has been said so far in this discussion as to the methods by which the candle power was taken, as to the burner that was used, as to whether the candle-power was corrected or uncorrected, or as to whether the make was corrected or uncorrected, and in making these comparisons it seems to me there is quite a large opportunity for results that seem to be very different but that may be exactly the same. I think the tendency to-day is to do more active work in correcting results than a number of years ago, and that is probably the case in experiments aside from Mr. Lamson's where an experimental works was conducted very carefully and all coals were very carefully tested. My memory is that Mr. Greenough, who always gave a great deal of thought to that subject, always took as the ready figure 80 candle feet—not as the maximum, but as the average working condition. In New York we use entirely the flat flame burner for testing, so that it is quite an ordinary thing to talk about 12 and 13-candle power as candle power results.

The President—It is very interesting to have these points brought out, and there is one point in reply to what Mr. Addicks said. A majority of people who have given testimony as to the results have been largely Massachusetts men. Of course, they are assisted very materially by a Commission who are very, very helpful in discovering as much sulphur and as low candle power as possible, and in all probability the conditions under which the various companies made their tests are the same as those existing at the time of the appointment of the Commission. I should judge that might be so.

Mr. Addicks—I had that in mind, Mr. President, but I could not differentiate as to whether these in New England were all in Massachusetts or not. I had in mind those of other States in New England when I spoke,

The President—It is a good deal as the saying about Massachusetts; she speaks for herself, you know. We hear very little from the other States in the Union. Massachusetts certainly has contributed more speakers on this question than any other.

Mr. Coffin—We have with us a gentleman who was the State Inspector in those good old days, when he inspected all the companies in Massachusetts as they are inspected to-day. I would like to ask him if it was not almost an exception in those days to find a company with a deficient candle power. I am sorry to say it is quite common to-day.

The President—We should like to hear from Major Hinman. I think he is the gentleman you refer to.

Mr. Coffin—Yes.

Mr. Hinman—I believe I am the only ex-gas inspector now living. (Laughter.) I think Mr. Coffin's question I can answer in the affirmative. In my official career for over 20 years—I am speaking from memory entirely—there were few years when I found more than 1 or 2 or 3 deficiencies in candle power; sometimes none at all. I read in the papers, occasionally I see it in the reports, of the deficiencies nowadays. Of course, I don't know just what the causes of these deficiencies are. What caused the candle power to be kept up to the standard in former years? The standard for the last few years of my career was exactly the same as it is now, as far as the candle power is concerned. One point about candle feet, perhaps, has not been taken fully into consideration, and that is the point of the correction for temperature of the station meter. I know our State inspections in my day, and undoubtedly my successor's, were corrected for temperature, and that temperature was 60°. I am more than suspicious that a good many yields that have been spoken of were measured by station meters where the temperature was 70°, or perhaps 75° or 80°, and were not corrected. That would make several per cent. difference in the results and tend to show a greater number of candle feet to the pound of coal.

Mr. Addicks—I want to say with some hesitancy, as my memory is rather defective, that it seems to me in the earlier days of the inspection of the gentleman who just spoke, the standard was 15 candles and not 16. Am I correct, Mr. Hinman?

Mr. Hinman—I intended to state—I was under the impression that I did state—that for the last few years it was 16. In the early portion it was 15.

Mr. Prichard—Before we close this matter, I am very glad that the Major called attention to the temperature question, because I think it is an unquestioned fact that every fellow here is running his meter 10° hotter than he did 10 or 15 years ago. In those days the fellow who did not run his condenser down to 60° and purify his gas cold was an exception. To-day we are all running our purifiers very hot, and the chances are that most of us are measuring the gas at 70°. If that fact

were taken into consideration the results would be poorer than we have outlined here.

Mr. C. S. Spaulding—Prior to 1904 or 1905 it was the custom, with our works particularly, and I think it has been the custom with other small works, to do away with the enricher entirely. During the summer I have always done so in three different works that I have been with. Never prior to the winter of 1904 and 1905 have I, as I say, used more than ½ gallon of oil during the winter; none during the summer. Never to my knowledge has the State Inspector given us less than 17-candle gas, running all the way from 17 to 20. I had no trouble whatever, never looked out for it, did not care if the Inspector came around or not, never gave it a thought, kept on the same old way. So it has come to my mind that it must be material, as I am running the same men exactly as I was and have been for the past 8 years, and I think that that will be the same also with a good many of the smaller companies that I know of, now that they are doing the same thing.

Mr. Mansfield—I want to add to what Mr. Spaulding has said. Ten years ago we were making less than half what we are to day, and it was not difficult at all to get from 5 feet to the pound to 10 or 12, figuring the oil, and using at that time about ½ of a gallon to 1,000 feet. To-day it is almost absolute impossibility to get 4.80, using ½ gallon of oil, the candle power averaging about 17.5, so it seems there must be some trouble somewhere. We have practically the same men. They are the same furnaces that were used 10 years ago, the same sized retorts, the same works in every way, and a great many of the same men. I am really merely substantiating what Mr. Prichard says, that there must be something the matter with the coal or material somewhere.

Mr. Barnes—We have recently been making some very thorough tests of the results obtained from the coal in Cambridge. I have not the figures at hand, but our chemist, Mr. Haddock, is here, and with your indulgence I would like to have him, if he can, state some of the results that we have been obtaining for the past 2 or 3 months.

Mr. Haddock—All I can say is that one grade of coal from one company has been running from .8 to .9 per cent. of sulphur. Coals from another company have been varying. Nine-tenths of a per cent. was what they used to send us, I suppose—I was not there at that time—but at present we are getting as high as 1.25 to 1½ per cent. sulphur. The yield from the coal at the present time is about 5 feet—that is corrected for temperature—and the candle power is about 15 on the average.

Mr. Anderson—Over 12 years ago—I think the Commissioners' reports will show it—we had no trouble in maintaining most every year an average of 18 candles and an average of 4.75, and overlay of coal, with 3 gallons of oil per ton. So I am of the opinion that the material we are getting to-day is the reason we are not getting the results.

Mr. Azoy—I seem to be the only representative of my trade here, but I think that a vote of thanks of the coal trade is due to Mr. Prichard for starting this discussion. For some years past, although I have only been connected with the gas coal trade for 4½ years, there has seemed to be an idea that almost anything will do for the gas maker. I think that stirring up a discussion like this will put every gas coal producing corporation on its mettle and give the goods that they sell of the same quality that they ought to give.

The President—I am glad there is one coal dealer whose epidermis is sufficiently thick not to be pierced, to his discomfort, by the general conversation that has taken place.

Mr. Azoy—Mind you, Mr. President, I have no axe to grind. I think it is just in fairness to the coal gas maker.

The President—We understand that, Mr. Azoy. We fully appreciate your position. Now the discussion has been extended, I think, possibly as far as is advisable, unless there is some objection. The next speaker will be Mr. J. B. Klumpp, to whom we shall take great pleasure in listening.

Mr. Klumpp's Narrative.

[Mr. Klumpp addressed the Association at length on his recent visit to England, and his speech was applauded.]

The President—With the permission of the Association I would like to extend our thanks to Mr. Klumpp for his very interesting remarks. We have all enjoyed them very much indeed. We would like to bespeak a paper for next year, which will give you, Mr. Klumpp, an opportunity to present some things that you left out. I should like to have you do so very much indeed, if it is possible. Mr. Secretary, possibly we had better round up business.

Adding an Associate Member.

The Secretary—I trust you will allow me to cast a ballot for Charles A. Roberts as an associate member. He is Assistant Manager of the New London Gas and Electric Company.

The President—What is your pleasure, gentlemen?

Mr. Nettleton—I move that the Secretary cast a ballot. [Adopted.]

The Secretary cast the ballot, and Mr. Roberts was declared elected a member of the Association.

The Secretary—I would also like permission to put any unfinished business into the report that can be done so easily,

The President—Will anyone make a motion instructing the Secretary to follow that course, if it meets with your judgment? [Seconded and adopted.]

The Secretary—Another associate membership applicant, Elward P. Fiske, who is with the Cunningham Company, I would like to put through the same course.

The President—You have haard the application read, gentlemen. What is your pleasure?

Mr. Prichard—That the Secretary cast a ballot. [Adopted.]

The Secretary—I would also like to announce that those who wish to go to the Medford Station of the Boston Elevated Railroad to see the large gas engines should take a car in the subway for Sullivan Square, at Sullivan Square take an Arlington car and get out at the Clarendon Hill car house, The power house is right behind the car house. There will be an opportunity to see that plant. It probably will take a matter of three quarters of an hour to get out there.

The President—If you cannot get a car take an automobile. What is the next business?

Minute to the Memory of Charles E. Sanderson.

Mr. Nettleton—Before we adjourn I would like to bring up a matter. I was very much shocked last night when I heard of the death of Mr. Charles E. Sanderson. He has been with us year after year—I heard someone say for 35 or 36 years—and what is true of this Association is true of nearly all of the Associations through the country. He was a regular attendant, generally sitting by the side of the stenographer, telling the names of the various speakers. I think it could fairly be said of him that he was better acquainted with the gas men of the country than any other one. In addition to that, he had such a kindly nature, such a pleasant smile and pleasant greeting, that we were all glad to meet him, and we are sorry that he is gone. I would like to move, sir, that the Secretary be directed to send a telegram to his family, expressing our sense of loss and our sympathy. [Seconded by several members.]

The President—Gentlemen, you have heard the motion which has been made and seconded. Are there any remarks before the motion is put? We will be glad to hear them.

Mr. McKay—I move that the vote be taken by a rising vote.

The President—Gentlemen in favor of the resolution as presented by Mr. Nettleton will rise. [All rose.] Be seated, gentlemen. If it is in order, or if you will make a motion, gentlemen, that a committee be appointed to frame suitable resolutions, possibly it would be becoming for us to do so.

Mr. Nettleton—I make that motion. I should have included it in my original motion. [Seconded and adopted.]

The President—I appoint as that committee Mr. Chas. H. Nettleton, Mr. C. F. Prichard and Mr. A. K. Quinn. Any other business?

The Secretary—I would like to ask the gentlemen who received the questions in regard to works temperature to kindly send their replies in to me, so that they may be collated.

The President—Is there any matter not taking up very much time that any member would like to bring before the Association? Hearing nothing, I wish on behalf of the officers to thank the members of the Association for the great assistance they have rendered in securing an active discussion on each and every question that has arisen. I thank you all very much, with the expressed hope that the new members will take their share next year in the preparing of papers; that the year will deal very kindly with you all and that our ranks may remain unbroken until next do we meet. I thank, you, gentlemen.

On motion the meeting was declared adjourned.

There is no truth in the report that Mr. Thomas Dolan, President of the U. G. I. Company, proposes to retire from active business. He was under the weather a trifle during the Ides of March, but the Sphinx of Broad street is certain to continue in the business sphere for many moons to come. And so may it be.

Gas and Gasoline Engines and Motors as Factors in Modern Machinery.

By "Observer."

The general introduction of various types of gas and gasoline engines and motors has been quite an important factor in the progress of modern machinery. One may find the engines operated by air, gas, and vapors of gasoline and petroleum oil, in very many of the important industrial establishments of the age. Many mechanical engineers engaged in designing machinery and general mechanical and engineering devices have informed me that they have taken the modern oil engines into consideration in connection with much of their work. The possibilities of the modern gas and oil engine, as applied to the employment of modern tools and machinery, are many. Your correspondent found the powerful little engines operating separate machines in many shops. I found that the several forms of devices for firing the charges in gas, gasoline and oil engines were in use, and will refer briefly to some of them in this article, using the accompanying illustrations to assist in the explanation of the details. Electric ignition is in use quite extensively in modern machine shops. This form of ignition is shown in the drawing, Fig. I. Three principles are involved. *A* marks the coil and *B* the battery. This is the internal form of circuit breaker, having a reciprocating rod, *C*, operated by a connecting rod with the necessary cams.

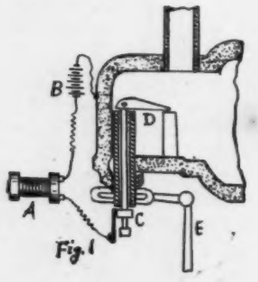


Fig. 1.

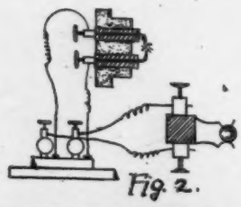


Fig. 2.

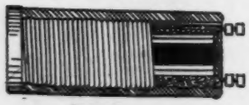


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

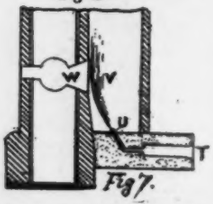


Fig. 7.

The mechanical movement is obtained through rod and lever, *E*. The interior cam is marked *D*. The insulation is made with a sliding tube with ample room in its bearings to allow the contacting headpiece to slip off promptly from its seat in the cylinder head, as indicated at *D*. I find that both the primary and storage battery systems are used. Sometimes the circuit breaker is connected between the battery and the induction coil, as shown in Fig. 2. This form of electric ignition is employed on various designs of engines with satisfactory results if the adjustment is correct. I found some of these patterns of electric igniters giving poor service, due to the wear of parts and improper adjusting of the wires and connections. It is necessary to have the insulation surface of the plug carrying the electrodes clean and free. I found this neglected in some cases, resulting in irregular service. The insulators are porcelain tubes, are set in brass and project on the end nearest the piston, carrying the spark to the air and vapor mixture igniting the same. In Fig. 3 is displayed a sparking coil. This sparking coil is designed with a quantity of iron wire, as may be seen in the cut. Referring to the forms of ignition and explosions seen in the gas and oil engines in use in connection with modern machinery and tools, I found the type of Bunsen burner in use in places.

A sketching of this design of burner is shown in Fig. 4. This description of ignition is in the shape of a mixture of aerated gas or vapor, and this composition flows through the tube constructed after the plan exhibited. The burner is set with its mouth, *M*, just below the igniting port in the cylinder. The main of the course is marked *N*, which main carries the mixture to the point of ignition. A shell is arranged about the mouth to keep the discharge steady. If it were not for this the discharge of vapor would be moved by the action of the atmosphere. A very good sized flame can be produced with this style of burner. In the next cuts are exhibited views of the slide valves of the common gasoline engine. Fig. 5 shows the position of the slide during the return or the compression stroke. In this the opening is as at *P*, being closed by the position of the ports. In Fig. 6 is shown the position of the movement of the ignition port from the flame to the cylinder port, with the opening made as at *R*. Fig. 7 is a drawing of the piston igniter, *V* is the gas jet, *W* is the passage through the valve shell and the further end of this passage enters the ignition chamber. The gas supply is through the opening at *T*. The little feed end for the gas is marked *U*. A vortex flame is produced by the revolving action of the combustible mixture in the chamber. These are some of the mechanical parts of the gas and oil engines I observed while visiting a number of modern machine shops. The engines are handy little devices for special service. The fact that the gas and oil engine has entered the field so largely, has tended to develop certain lines of work in the modern shop. I found that departments were established in some machine shops and new and special modern machine tools put in solely for the working on gas and gasoline engines.

Death by Ground Leakage of Illuminating Gas.

Some weeks ago reports were sent by the press throughout the country to the effect that a family of 6 people in Winooski, a relatively small place near Burlington, Vt., were all killed by illuminating gas through leakage of the gas through the plumbing fixtures of the house. If this statement were true it would readily be seen that here is a case where something of value could be learned either with regard to the sealing of traps or of defective connections between fixtures and the drainage system. However, through Prof. Edward Robinson, of the Mechanical Engineering Department of the University of Vermont, the *Metal Worker* learns that the house in which the people lost their lives had neither any gas connection nor any sewer connection. The gas main passed the house at a distance of 10 to 15 feet from it, and directly in front of the house was a drip or connection through which a gas pipe could be run to the house in case it should ever be required. There was a leak in this connection, which the Company claims was due to the frost throwing the main. The ground being frozen, the gas worked its way, it is calculated, under the surface of the ground to the cellar and thence into the house. It is the common report that the family mentioned to neighbors for a week previous to the accident that there was a smell of gas in the house cellar, but that the Gas Company was not notified and nothing was known of the leak until the accident.

Reducing Dust and Hardening Roads by Surface Applications.

In the course of an admirable address, delivered by Mr. J. W. Howard, of this city, on the topics named in the heading—the occasion being the annual convention of the American Road Makers' Association—the speaker had this to say concerning methods of interest to gas makers:

Impregnating Roads with Special Crude Oils.—The application of certain oils to roads practically began in California in 1894, when crude oil from Summerland oil wells was used on the Ortega road, 5 miles from Santa Barbara. It was sprinkled to lay the dust of the soft soil of the road. A slight hardening of the road was observed from the repeated applications of the thick maltha or asphaltic oil. A few other roads in California were sprinkled until about 1900, when the use of its oils on roads rapidly extended from the many oil centers in that State, until to-day oil is used for suppressing dust and hardening roads, with varying success and failure, in about 40 counties of California, and to an extent of a little more than 2,056 miles. California and other crude oils are now being used experimentally to a limited extent in other States and in Europe. Persons who have not seen the peculiar local California conditions, as its climate, long dry season, roads of dry volcanic or alluvial dust, sand, clay and loam, and roads made of these, saturated with the peculiar maltha or thick, sticky, asphaltic oils, must not assume that they can use those or other kinds of crude oils in the same way and with the same results on other kinds of roads, with

heavier traffic and in climates with rain at short intervals and frosts in winter. California crude oils and a few others, with marked exceptions there and elsewhere, contain maltha or soft asphaltum and resemble thick, sticky molasses. Such oil is almost a liquid asphalt, and when heated and spread upon certain soils, clay, sand or gravel, mixed with such soils, will impregnate or can be harrowed into such roads. They are then rolled and compressed by traffic and will consolidate and form a pliable, crude, asphaltic crust. Oil must be applied at intervals thereafter and no water must get into the yielding subsoil under this weak bituminous or asphaltic crust.

Let us glance at a few actual records of oiling roads. In Contra Costa county, Cal., some macadam roads were oiled with 12° to 18° B. oil, costing 65 cents per barrel, and applied to the road cold, cost about $75 a mile. It was not satisfactory. It does not help macadam as much as more absorbent soft roads.

Kings county, Cal., has about 40 miles oiled, sandy roads. Long stretches became ground up and give off dark dust. It is necessary to constantly oil these roads to such a degree that wheels and horses throw up the surface and occasional rains wash away the oil and road. Still it is better than no oil because it hardens the sand and permits faster travel and heavier loads.

In Sacramento county, Cal., I noted several gravelly, clayey and sandy loam roads and a little macadam. The thick, sticky oil helps all these by suppressing dust and conserving the roads. But do not expect to find there as clean, smooth surfaces as are found in many States having better constructed roads from better materials.

Probably the best constructed and maintained oiled road of California is the driveway of Golden Gate Park near San Francisco. The oil when cold is between 14° and 16° B. It was heated to about 300° F. and sprinkled while hot on the road, men following closely to stir the oil into the road with rakes. The road, of course, was first properly graded and shaped. Its surface was made smooth, then soaked with water to loosen it. It was next well dried to a depth of at least 1 inch and the oil applied as stated during warm dry weather. Repairs are constantly made by promptly sweeping out any little hole that forms, putting in a little oil, adding gravel and stone dust to absorb the oil and tamping until firm. The oil costs 72 cents per barrel and 400 barrels per mile of 16-foot road were first applied. Since then 300 barrels per mile have been applied twice a year, or 600 barrels per year. The tendency is to form into ruts and a slight lowering of the whole road surface. This last is caused by rain water working through the surface and carrying away the road material from under the asphaltic oil crust. Although expensive, it is so important a drive out of San Francisco that it is worth all it costs.

Kentucky oil was used in Fayette county, Ky., about 1904-5-6. At least 3 oilings were needed the first year at a cost of little more than 6 cents per square yard. At least one oiling per year for light travel, costing about 3 cents, and two oilings per year for numerous travel, at about 5 cents, will be needed. It is too soon to report on the efficiency and economy of this oil and work.

Near Jackson, Tenn., during 1905, a crude oil was used on a flash point 169° F., specific gravity, 0.92. It was applied to a road 18 feet wide and covered about ½ mile. The labor cost $.0057, and I estimate this crude oil, f.o.b. station, Jackson, would cost with profit about 7 cents per gallon. Thus 0.48 gallon per square yard would cost $0.0336. The total cost of oiling, therefore, was about $0.0393 per square yard for one application. The oil soaked into the macadam, left no coating on top, and when examined 7 months later it was of no permanent benefit to the road and had ceased long before to suppress dust. The process should have been repeated at least three times the first and twice per year thereafter to judge this oil and possible results.

A heavy residuum oil left after evaporating the lighter oils was also tried near Jackson. It had a flash test of 308° F., and a specific gravity of 0.97. The labor applying this heated oil was $0.0078. I estimate the cost of 0.71 gallon per square yard at 7 cents per gallon to be $0.0497, making a total of $0.0575 per square yard for one application, including cleaning the macadam and spreading sand on top of the heavy residuum oil. When examined 7 months later, a layer of compacted dust, about ¼ inch thick, remained, while some of the road surface had been washed and some blown away. This surface should have received a second treatment within the first 3 months and probably two per year thereafter. Then some conclusion would be possible on what now appears to be a success.

Liverpool, England, in 1902 and 1903, tried an oil on some suburban macadam and found that it cost less than constant water sprinkling; but the kind of oil used made the surface of the road oily and slimey in dry and more so in wet weather, and of offensive odor. Its use was stopped, as well as that of previously used calcium chloride solutions, in watering carts. The solution pleased them better than oil, but proved too expensive for suburban and country use.

General Rules for Oiling Roads.—I learned from California practice that the crown of a road of soft materials (for it is doubtful if any crude oil really helps macadam) to be oiled must be high and its sides well drained, because water, with or without freezing, floats much of the oil away or gets under the oiled crust and softens it. The hotter the oil when applied, the warmer the weather and the drier the road, the better. When heating crude oil allow for an expansion of 15 per cent. Heat it between 225° to 300° F. Use oil of 12° to 16° Beaume, containing at least 35 to 50 per cent. of thick maltha or liquid asphalt. Not over 3 per cent. of foreign matter and water and the balance should be light bitumens, some of which should oxidize and some evaporate from the freshly oiled roads, leaving an elastic, dustless crust of road material and heavy parts of the oil. Oiling by hand is expensive and not uniform, especially when it must be done by the mile. Special machines for oiling, harrowing, spreading sand, etc., are to be had, although still imperfect.

In California, according to soil, from 175 to 400, sometimes 600, barrels (of 42 gallons each) of asphaltic oil are needed per mile of 10 to 16-foot road per year. Two or three treatments are needed on a new road during the first year, if the road is of a loamy or sandy nature. After a road in California has been well oiled and a crust is formed, care must be taken not to break through the crust. Prompt repairs are imperative. Do not flood the road with oil; it is better to use several successive applications. An excess of oil on a road is disagreeable and will injure paint on vehicles, harness or clothing and seems to affect rubber tires.

Road materials, which if wet would pack firmly under roller or traffic and still remain slightly porous, are the best for use by saturating with suitable thick adhesive oils. These oils suppress dust and harden such roads. Road materials of certain clays, earths and gravels which when wet pack tight or bake in the sun, and which pulverize into dust, must be either loosened up by harrowing or otherwise made porous before being oiled, and then must be covered with sand, screenings or the material of the road. Oiling roads furnish cases where a little knowledge is dangerous, and where much knowledge and experience must be employed to select suitable oils and to use them correctly.

In regard to the suppression of dust by means of oils it is impossible to prescribe any formula. There are a great many kinds of oils produced by nature. The naphtha or light oils of Russia, and the paraffine oils of Pennsylvania, Ohio and elsewhere, will not do; and I doubt if any of their products can be successfully and economically used. The Texas, Kentucky and Kansas oils, and some others, may possibly be used, if specially prepared or applied in special ways. The California maltha or asphaltic oils are successful with the loamy, sandy and alluvial soils in that and like climates, but not yet with macadam. Transportation is likely to prove too expensive for those and other suitable oils elsewhere than near their sources of production. The use of crude oil is a local question for each place and requires careful investigation and the best of advice before undertaking its use; also, careful supervision when used and instruction as to prompt repairs.

(To be Continued.)

A Gas Burner Soda Kettle.

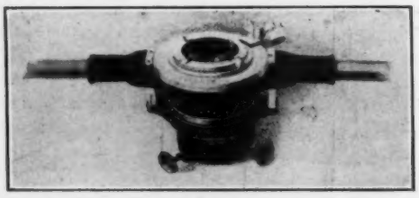
A contemporary calls attention to the fact that a new plan of kettle for use in connection with the working of soda and potash has been on the market for some time and is meeting with much favor. As shown in the illustration it is arranged to give a constant, predetermined temperature of the bath used in cleaning work of oil and greasy dirt in machine shops, factories and electroplating works. The bath is heated by a burner to which gas is admitted through a valve controlled by a thermostat. The valve remains open until the heat of the kettle reaches the point at which the thermostat is set, when the heat, acting through the thermostat plug extending into the bath, automatically opens a water valve, admitting pressure through a pipe to the gas valve, closing it and shutting off the supply of gas to the burner. When the bath falls below the required temperature the thermostatic valve closes, the water in the connecting pipe discharges into the slop basin and pressure is released from the gas valve, admitting gas, so that the burner is again lighted by a pilot lamp which is kept constantly burning.

The slop basin is at one side of the kettle and may be seen at the top near the right in the illustration. It is arranged so that the dirty water can be easily disposed of. It also acts as an overflow if the water sup-

ply should be accidentally left open and is convenient in getting rid of scum. The cover can be removed at any time and the entire volume of the kettle made available for large work.

The Beaver Easy Worker Die Stock.

A very well set-up, easy and rapid working die stock is that herein illustrated. It is a product of the Borden Company. The device solves



the problem of threading four sizes of pipe, 1 inch to 2-inch with a single set of chasers, thus saving the time and trouble of changing dies. It is built on an easy working principle with narrow chasers, which gradually recede while threading to form the taper thread, and one can thread 2-inch pipe, it is stated, with one hand.

The teeth in the chasers are so formed that the first tooth removes only a portion of the metal, and each succeeding tooth cuts a little deeper, so that the work of cutting is equally distributed over all the teeth, thus requiring less frequent grinding. The dies are set to any size pipe by simply shifting the cam lever, and can be likewise set over or under standard to meet the variations in fittings, and the construction is such it is found that the dies cannot slip. A clever feature of the stock is a tension screw collar, which holds the chasers down tight in perfect alignment, preventing chips from working in and taking up any looseness or future wear to prevent threads stripping.

Horse Power Rating of Gas Engines.[1]

By Mr. Henry C. Hart.

That there is a wide difference in the methods employed by manufacturers in arriving at the rating of the horse power of gas engines is evident from the varying nature of the results arrived at, as shown in the claims set up by them regarding the merits of their respective engines of practically the same type and dimensions.

There is of course no mystery about the operation of a gas engine and the calculation of the horse power of any given engine, or of at least its maximum possible horse power, is a very simple matter by use of the method I purpose to set out in this article.

1. The *Gas Engine.*

As there is no value to the power of any engine excepting its brake horse power, so should there be no other rating than that based upon the power that can be actually delivered if the individual engine was perfect in design and construction and properly adjusted.

It will be found that there is a certain value to the fuel burned which, although it varies with the type of the engine and to some extent with the dimensions, can not in any possible manner be exceeded, and in fact can only be attained by perfection in design, workmanship and adjustment, and it seems reasonable and fair that this possesses the basis of horse power rating.

As the perfect adjustment of an engine means that the best possible mixture of the fuel with the air is being employed, it is not necessary in arriving at a proper rating to ascertain the fuel actually burned, but merely to measure or calculate the quantity of explosive mixture used; neither is it necessary to know exactly the quantity of mixture actually drawn into the explosion chamber and burned, but to know how much *should* have been so drawn in and burned were the engine properly designed, constructed and adjusted.

The basis of the rating then should be the amount of brake power the engine *should* be capable of delivering in proportion to the quantity of explosive mixture that *should* pass through it in a given time.

If 2 engines of the same pattern made by the same manufacturer are set side by side and operated under the same conditions, they should give the same results; if they do not, then there must be a difference in the workmanship or adjustment.

If 2 engines having the same dimensions, but of different makes, are set side by side and operated under the same conditions and the results are found to be different, then the difference *must* be due to the design, or the workmanship or the adjustment. Therefore we may conclude that a rating based upon the calculated fuel consumption under ideal conditions is a fair and proper one, and that the manufacturer who turns out his engine perfect in design and workmanship will be able to deliver the power at which it is rated, while imperfection of design or workmanship must inevitably be shown if the rating mark can not be attained.

There is, however, another factor to be determined, and that is the number of revolutions per minute at which the rating should be calculated. In every engine there is of course a "critical" speed below which or above which the power per revolution decreases from the maximum; in any 2 engines in which the design, workmanship and adjustment are the same and perfect, this critical point must be the same, and any imperfections in either must result in a lowering of the critical speed point and consequently in the maximum power.

It is therefore necessary in order to calculate the rated horse power of our engine to establish a value for this critical speed in a perfect engine of any given dimensions; this is evidently a hard proposition to solve with accuracy, but it is practically already solved by practice, as it is pretty well known what is the limit of useful speed in gas engines; useful speed, however, is by no means the same as the most economical speed, neither is the most economical speed the best speed at which to run an engine unless its power is considerably in excess of the work it has to accomplish; for as a matter of fact the decrease in the power per revolution is very slight for quite considerable variations from the critical speed point.

For example, a single cylinder, 4-cycle gasoline engine having a piston 6 inches in diameter and 6 inches stroke and in all respects perfect in design and workmanship should have a critical speed of say 500 r.p.m. If this speed is increased 10 per cent. or to 550 r.p.m., there will be a loss of power per revolution of about 3 per cent., but if the speed is increased 20 per cent. or to 600 r.p.m., the loss of power per revolution may be as high as 10 per cent., while at 700 or 750 r.p.m. the total B.H.P. will likely fall below what it was at the critical speed of 500 r.p.m.

The critical speed of small gasoline engines—that is, engines below 12 by 12 dimensions—will be found not too far from 6,000 inches of piston speed per minute, and for the sake of uniformity it would be well if this speed were used exclusively in rating the horse power of this type of engines.

Considerable experience with brake horse power tests of small gasoline engines allows me to speak with confidence regarding this critical speed point, and with a conviction amounting to almost certainty regarding the proper co-efficient for the maximum power value of 1 cubic inch of explosive mixture as measured by the cubic contents of the piston sweep in 4-cycle engines.

This co-efficient varies somewhat according to the dimensions of the engine.

But I find that in very small engines—say 4 by 4 or less—that it is

very difficult to so adjust and time the revolutions as to get results of 4-foot pounds of work for each cubic inch of explosive mixture; a 4 by 4 engine has a piston sweep of about 50 cubic inches. Better results can be obtained from engines having larger sweep of piston principally on account of the decreasing ratio of cylinder walls to piston sweep as the dimensions increase, this increase being modified very greatly by the necessarily diminishing speed and consequent increase in time of exposure of the hot expanding gases to the cylinder walls.

It is, of course, impossible to say what the proper work co-efficient is for every variation of size of engine, but I use the following values, and I know of no instance where properly conducted brake horse power tests have shown better results.

For piston sweep of 50 or less cubic inches, work co-efficient per cubic inch of mixture equals 4.

For piston sweep between 50 and 100 cubic inches, co-efficient equals 4.5

Between 100 and 250 cubic inches, co-efficient equals 5.

Between 250 and 750, co-efficient equals 5.5; above 750, co-efficient equals 6.

In very large gas engines of from 500 to 1,000 and more horse power the co-efficient probably may be as high as 6.5 or possibly under test conditions as great as 7. It will be found, however, that by applying this method of computation to statements of work done in larger gas engine tests, claims for greater results than is shown by a co-efficient of 7 are seldom or ever made.

It is not at all unusual, however, to see it claimed that some particular make of small automobile or marine gas engines will develop brake horse power equivalent to a co-efficient of 7 or 8 or more, but such results may be depended upon as being absolutely impossible under any conditions whatever and branded as false without a moment's hesitancy.

To calculate, then, the possible brake horse power of any 4-cycle engine, it is only necessary to multiply the piston sweep by the number of possible working strokes per minute, this result by the co-efficient and divide the result by 33,000. Or let the area of the piston be represented by A. The length of stroke by S. The number of possible explosives per minute by R, and the co-efficient by C. Then

$$\frac{A \times S \times R \times C}{33{,}000} = \text{B.H.P.}$$

or in the single cylinder 4-cycle 6×6 engine at 500 r.p.m.

$$\frac{28.3 \times 6 \times 250 \times 5}{33{,}000} = 6.44$$

I am not able to speak so positively regarding the proper co-efficient that should be used in calculating the brake horse power of the so-called 2-cycle engines, but the consensus of such information as I have indicates that the co-efficient should be at least 25 per cent. less for the same dimensions than that for the 4-cycle engine.

For this engine, then, the calculation for a 6×6 single cylinder engine would be

$$\frac{28.3 \times 6 \times 500 \times 3.75}{33{,}000} = 9.66 \text{ B.H.P.}$$

In large gas engines of the 2-cycle type, say 500 horse power and over, the co-efficient does not vary much from that of the 4-cycle engines, as the sources of loss can in these sizes and speeds be nearly or entirely eliminated.

In small, fast-running gasoline engines, however, the 2-cycle type, though much more powerful for the same weight and room occupied, is undoubtedly much less efficient as regards fuel economy than the 4-cycle type.

This must not be considered as a criticism of this type of engine, for in my opinion the 2-cycle type has many advantages over its older brother for very many uses.

The writing of this article was suggested to me by reading an inquiry on page 47 of the *Gas Engine* for February, 1907, in which the inquirer wants information regarding the horse power of a 6-cylinder engine of 12-inch bore, 14-inch stroke and a speed "calculated" for 257 r.p.m., and also information regarding propeller dimensions. As the inquirer does not give the type of engine or any suggestion regarding the boat the engine is to be used in, you were unable to give him much satisfaction. A calculation of the power of the engine according to the formulas suggested by this article shows that his engine, if of the 4-cycle type, is entitled to be rated as 185 B.H.P., the critical speed being 214 r.p.m. At 235 r.p.m. it would probably develop about 200 B.H.P. If the engine is of the 2-cycle type, it is, according to our formula, entitled to rate as of 278 B.H.P. at 214 r.p.m. and should develop about 300 B.H.P., if run at 235 r.p.m.

Mr. Dugald Clerk on Flame Engines.

In the course of a lecture on this subject, delivered by Mr. Dugald Clerk, Mem. Inst. C.E., before the Royal Institution (England), the speaker began by pointing out that mechanical power can be obtained by flame by four different methods: (1) Filling a vessel or cylinder with a mixture of gas and air and igniting it, causing a slight explosion, and the excess pressure blowing off through a valve; (2) admitting a charge of atmospheric air and inflammable gas or vapor, at atmospheric pressure, into a cylinder containing a piston, cutting off access to the atmosphere and the gas supply, and igniting the mixed charge—a mild explosion following, the pressure rising in the cylinder, and the piston being driven forward to the end of its stroke; (3) sending into a cylinder containing a piston a mixture of inflammable gas and air in a compressed state, and then igniting the mixture; and (4) supplying a cylinder with gas and air under pressure, but igniting the mixture at a grating or gauze as it enters the cylinder, so preventing the pressure from rising above that at which the mixture is admitted. These four modes of action, and the combinations or modifications of them, include all the fundamental methods used in obtaining motive power from flame which have been attempted in the course of the past hundred years. In the early part of the last century, the vacuum methods were favored. In the year 1820, Rev. W. Cecil, M.A., of Cambridge, in a paper read before the Cambridge Philosophical Society, gave an account of probably the first gas engine. Six years later, Mr. S. Brown built an engine depending upon the flame vacuum method, which appears to have been the earliest gas engine ever worked on a considerable scale. This method, however, never really produced a thoroughly commercial motor. Many engines were built on the atmospheric or non-compression explosion principle, the most successful one being that of Lenoir. The first and second methods were found disadvantageous, and consequently they are not now used.

In all modern gas or petrol engines, the third method—viz., compression of the charge of inflammable mixture before ignition—is employed. Many attempts to construct engines operating upon this principle were made before success was achieved. One of the earliest feasible compression gas engines was that described by Mr. Wm. Barnett in 1838, which possessed many of the features of the successful engines of today. Later proposals were made for similar engines, both in France and in Germany; but the first inventor to succeed in really overcoming difficulties to a sufficient extent to produce a commercial engine was the late Dr. Otto, of Deutz. The great majority of modern gas and petrol engines now operate on the Otto cycle, which has many advantages. The charging and discharging of the gases are accomplished easily; the flow of heat through the sides of the cylinder is not too continuous, and the cycle can be operated at very high speeds. Its main disadvantage is the necessity for two complete revolutions for every power impulse. The lecturer said he had devoted much time and experiment to obviating this, and in 1881 he invented a cycle of operations which gave in the same cylinder one power impulse at each revolution. It is now known as the Clerk cycle, and it comes next to the Otto in the order of the number of engines running in various parts of the world. Mr. Clerk exhibited two sections showing the cycle, and also a small engine built to his designs 24 years ago. He stated that the German authorities had requested him to present the engine to the Munich Museum, to form a link in the history of the internal combustion motor, and he had consented to do so.

In the early days of gas engines, great difficulty was found in obtaining regular consecutive ignitions at a sufficiently rapid rate. Lenoir used an electric spark, but it was not then reliable. The early Otto engines had flame ignition, and the igniter served admirably for them—acting usually from 80 to 100 times per minute. When, however, ignition had to be more frequent, as in engines constructed in accordance with the Clerk cycle, the Otto flame was found too slow. The lecturer accordingly produced a modified flame igniter, which he showed in section. It depended on supplying a port with inflammable mixture from the cylinder itself, the gases, being already mixed, contained within themselves sufficient oxygen to support combustion; and accordingly the flame filling the port could be very rapidly ignited—as many as 300 ignitions taking place per minute. These flame igniters gave way to hot tube igniters about 20 years ago, and now electric forms of ignition have been rendered relatively so perfect that they are fast displacing all tube methods. Mr. Clerk directed special attention to the regularity and the certainty of the various operations—charging, compressing, igniting, expanding and exhausting—going on in an ordinary stationary gas engine, and characterized them as truly marvellous, when the difficulties which have been faced and overcome are con-

sidered. The gas engine of medium size runs at about 180 revolutions per minute, or 3 revolutions in a second. The forward stroke is completed in ½ of a second; that is to say, the intensely hot gases are produced in the cylinder, the pressure attains its maximum, and expansion occurs for the whole power operation, in ½ of a second. Ignition of the mixture, from beginning of the explosion to the attainment of the maximum pressure, takes from $\frac{1}{20}$ to $\frac{1}{10}$ of a second. It is surprising to be able to accomplish these operations with such certainty at these speeds; but the experience with the petrol engine is still more so. In an ordinary 4-cylinder motor car, with the engine running at 1,200 revolutions per minute, 2,400 explosions take place in that time, the whole of the operations of a complete revolution being performed in the infinitesimal space of $\frac{1}{10}$ of a second. "These considerations," said the lecturer, "show what an advance has been made in handling flame as a working fluid during the last 30 years. It has taken more than 100 years to attain our present knowledge of the means of handling and controlling flame as the working fluid in these engines. But the last 30 years has seen the greatest development, so far as practical matters are concerned; so that now over 2,000,000-horse power of stationary gas engines operated by flame are in use in the world." Mr. Clerk at this point of his lecture showed a section of the Diesel engine as an example of the fourth method of obtaining mechanical power by flame.

Though great progress has been made in the practical control and utilization of flame and gaseous explosions for the purpose of producing motive power, the lecturer told his audience that little is as yet known as to the actual properties of the working fluid so utilized. Science still, he says, requires to investigate the properties of gases at high temperatures, in order to fill the gap in our knowledge at the upper end of the scale which Sir James Dewar has so ably filled at the lower end. Consequently, it is not for the present possible to formulate a complete theory of the internal combustion motor, in the absence of knowledge of the properties of the gases constituting its working fluid at the very high temperatures attained. The subject is a difficult one, and involves not only the statical properties of these gases, but requires a knowledge of the conditions and rate of chemical combinations occurring in minute fractions of a second, and the conditions of dissociation of compounds such as carbonic acid and steam at high temperatures under varying temperatures and pressures. MM. Mallard and Le Chatelier and MM. Berthelot and Vieille took up the subject of gaseous explosions, and made experiments with numerous gases and oxygen, and also coal gas and air; but the records examined by the lecturer appeared, he said, to be subjected to very great oscillations of pressure. A few years later, he made a series of experiments with an apparatus of which he exhibited a section; and they showed clearly that the whole of the heat present was not evolved at maximum temperature, assuming the gases to have their ordinary specific heat at the high as well as at the low temperatures. His conclusion was opposed to the views of the French physicists named.

To enable some investigation to be made on different engine cycles, it appeared to the lecturer to be desirable to consider the gas engine as an air engine pure and simple, operated with air of constant specific heat—the air being a perfect gas, and the chemical action being assumed as merely a means of heating the air through the desired range of temperature. Calculating on this simplified theory, it became evident that the efficiency to be obtained in an air engine without heat losses was dependent mainly upon compression. Working out this theory showed that while the utmost that could be theoretically expected from a non compression engine of the Lenoir type was 22 per cent., compression supplied means of getting theoretical efficiencies of as high as 60 per cent., with practicable ranges of pressures and temperatures. The air standard has proved its utility as a guide to the engineer for a quarter of a century, and is definitely adopted by the Institution of Civil Engineers as the official standard, after exhaustive trials of engines of different sizes.

The simplified theory of the internal combustion motor has been most useful in pointing out the way to better efficiencies, and with its use these have risen from 16 per cent. in 1882 to a maximum of 37 per cent. in 1906. To enable futher progress to be made, however, it is now necessary to know more of the actual properties of the working fluid, and the lecturer, at some length, gave particulars of investigations he had carried out with this object. He said that by the method he adopted he had been able to calculate full-load diagrams taken from the engine, and account for 106 thermal units when the calorimeter showed only 105 to be present. It therefore enables an investigator to determine the apparent specific heat and the heat flow to the cylinder in any engine under working conditions. In this connection, reference was made to some valuable work done by Prof. Hopkinson, of Cambridge, in attacking the problem of the loss of heat to the closed vessel; and a section of his apparatus was shown. At present Mr. Clerk has a number of experiments in hand, on engines of different sizes, with his new optical indicator; and he hopes to get accurate figures, both as to specific heat and continuous combustion as well as heat-flow through the cylinder sides.

In conclusion, the lecturer said that engineers were now keenly interested in the progress of knowledge as to the working fluid, because without this knowledge it was impossible to attain the ultimate practicable heat-conversion by means of the internal combustion motor. At present, however, this motor was by far the most efficient means of converting heat into mechanical work. Already 37 per cent. conversion had been achieved; and, so far as present indications pointed, it would be possible to make an engine converting more than 50 per cent. of the whole heat given to it. This result has been arrived at only by the study of the properties of flame, not only on the physical but also on the chemical side; and, on the mechanical side, by using devices of sufficient delicacy and rapidity to deal accurately with large volumes of very difficult working fluid. There was still plenty of room for more investigators—both physicists and chemists—in the promising field of which he had been speaking.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE following tenders are asked for by the Washington (D. C.) Gas Light Company, the same to be addressed to the Company's office, 113 Tenth street, Washington, D. C., and to be in hand there by 12 noon of the 12th inst.: Best screened gas coal, ¾ inch, to be delivered f.o.b. Company's wharf, 26th and G streets, as required within the twelve-month; 35,000 tons, gross, for East End Station works, to be delivered f.o.b. cars on tracks in yard, 12th and M streets, S.E.; 20,000 gross tons, to be delivered in such quantities as may be demanded at times during the year. Anthracite: 20,000 gross tons anthracite, broken coal, for the Station at 26th street, and 6,000 gross tons for delivery at the East Station. Deliveries of the anthracite to be made under like terms respecting the deliveries for bituminous. Tenders should be sealed and addressed to the Washington Gas Light Company, and be marked "Proposals for Coal."

GENERAL MANAGER SCHUTT, of the Mahanoy City (Pa.) Gas Company, in his plannings for the year, will virtually renew the main system, in that by Nov. 1st there will not be a street pipe in the system under 4 inches in diameter.

"THERE are ways and means of making a gift," writes T. R. F., of Bridgeport, Conn., "but the queerest of means in the giving line that ever came under my observation is one recently tendered by the New Britain Gas Light Company to the people-at-large. Some days ago the Company offered to illuminate the soldiers' monument on the main square in the city without charge, provided the city would order the police to extinguish the lights at midnight. Why not have made the offer unconditionally, or not at all?"

MR. A. R. MARTIN, writing from Wilkes-Barre, Pa., under date of March 29th, says: "Last week a verdict of $800 was returned in favor of plaintiff in the action entitled, J. H. Orr vs. the Gas Company, of Wilkes-Barre. The suit was for $5,000 damages to property on Regent street, from water that backed up from the stream known as Solomon's Creek. The plaintiff claimed that the Company built a main a few feet above the low waters of Solomon's Creek, and that some years ago, during a great inundation that swept the valley, it acted as a barrier to the travel of driftwood, etc., and the dam so formed caused the water to flow back upon adjoining premises. Plaintiff's property was damaged as a result, hence the action. The Company's defense—and it certainly sounded a reasonable one—was that the flood was an extraordinary visitation, and that no negligence could be traced to the Company connected with the damage to plaintiff's property."

THE residents of Minot, N. D., have organized the Minot Gas Company and have applied to the Council for a governing ordinance. The officers of the concern are: President, John H. Lewis; Vice-President, O. M. Pierce; Treasurer, C. H. Parker; Secretary, R. C. Sanborn.

THE Directors of the Rochester (N. Y,) and Eastern Rapid Railway have elected Mr. R. E. Danforth, of the Rochester (N. Y.) Railway Company, General Manager of the Rochester and Eastern Railway, and Mr. R. M. Searles, General Manager of the Rochester Railway and Light Company, has been made General Manager of the Ontario Light and Traction Company, and of the Canandaigua Gas Light Company. More's the power to you, bustling Bobbie.

MESSRS. GEORGE S. NIXON, G. H. Hayes and George Wingfield comprise the syndicate that purchased the Peoples Gas Company, of Los Angeles, Cal.

THE United Gas Company, which some time ago commenced supplying gas of the natural sort to the residents of Wichita, Kas., has purchased control in the Wichita Gas, Electric Light and Power Company.

In an order made public the 26th ult. the Massachusetts Board of Gas and Electric Light Commissioners sustains the appeal of the Haverhill Electric Company from the decision of the Board of Aldermen of that city in granting to C. H. Hayes rights to lay and maintain wires, cables or conductors for transmitting electricity across Main street in Bradford and across Washington street at the points where these streets are crossed by the Boston and Maine Railroad. The case is similar to some others that have been decided by the Board, but brought up certain new questions, and the decision states at some length the policy of the Board in regard to restricting competition with established companies. The Board states that under the grant as authorized by the Board of Aldermen Mr. Hayes would have full authority, without further action by any public body, to supply electricity to any and all persons within the area bounded by the Boston and Maine Railroad, Essex and Washington streets, as well as in the area bounded by the railroad, Washington street, Washington square park and the river, and along the river front on the south side for a distance of over a mile. The Legislature, it is held, has expressly left to the discretion of the Board the question of admitting two or more companies in the same territory, indicating that in the opinion of the Legislature occasion might arise when more than one company would be not only justifiable but desirable as well. The Board contends, however, that it is for the party seeking the right to exercise the privilege of selling electricity to show that the interests of the public fairly require that the Board should admit him to the exercise of the privilege, and in this case this burden has not been sustained. It was brought out in the hearing before the Board that Mr. Hayes in his individual capacity and for 4 years as the C. H. Hayes Corporation has been supplying electricity to certain concerns whose places of business adjoin his present location, and at the hearing it was stated that he desired only to be able to continue to supply these firms from the location to which he intends to move in Bradford, having been forced to abandon his present location through the abolition of grade crossings and the relocation of the freight yard incidental thereto. The Board states its belief that these reasons are not sufficient for affirming the grant of the Board of Aldermen, as it was not shown that the service of the present Electric Company is inefficient or that the Company has been unable or has refused or neglected to do its full duty of supplying the inhabitants of Haverhill with electricity at reasonable rates and without discrimination.

Mr. R. K. Wehner, Treasurer of the Isbell-Porter Company, informs us that the Company has opened a Western office in Chicago, Ills., in suite No. 616, "The Rookery." The position of Western Sales Engineer to the Company has been created, and that clever engineer, Mr. Henry I. Lea, has been appointed to fill it.

Bids for the improving, altering and enlarging the gas plant of the Kennebec Light and Heat Company, in Augusta, Me., were to have been opened last Saturday.

"Mr. C. H. Dunbar, whose appointment last fall to the post of General Manager of the Houston (Tex.) Gas Company was duly chronicled, seems to have lost none of his persuasiveness, for we note that his Directors have ratified his request that the holder plant of the Company be enlarged to something on the safe side. The Company had been working at least close to what might be called the safety point. The vessel is to have a retaining capacity of 1,000,000 cubic feet, is to be located on the plot purchased some time ago at the junction of Magnolia and Crawford streets, and is to be completed by October 15th. If we mistake not this, when completed, will be the largest storage holder in Texas, and it gives me satisfaction to add that the Company's President, Mr. T. W. House, is bound to see to it that its progress will go steadily on towards the mark set for it by the leading one of its founders, Mr. T. W. House, Senior.—L. M. B."

General Manager Joseph E. Nute, of the Fall River (Mass.) Gas Works Company, is arranging for a piece of main work that will require quite a bit of thought and attention. That is, the extension of a main on the bottom of the Taunton river from the foot of Davol street to the Somerset bank through the district beyond.

A correspondent in Los Angeles, Cal., writing to the Journal under date of March 27th ult., says: "Thinking it might interest you, let me say that the property of the San Luis Obispo (Cal.) Gas and Electric Company, previously controlled by San Francisco interests, was recently reorganized. As the Company now stands, Mr. W. F. Boardman, of San Francisco, continues as President; Mr. B. F. Pearson, of Los Angeles, is Vice-President and General Manager, and Mr. J. M. Berkley has been appointed Secretary and Treasurer. The new proprietors have great hopes for the property and its future development, and they propose to put out all the money needed to place the gas and electric plants in up-to-date condition. The scheme of betterment includes the taking on of a day load in the electric current division."

We were in error in stating that Mr. I. C. Baxter has retired from the Presidency of the James Gardner, Jr., Company, of Pittsburgh, Pa. What we should have said was that the firm of Baxter & Young was dissolved by mutual consent.

Mr. D. Perry Skellenger, Secretary and Assistant Treasurer of the Morristown (N. J.) Gas Company, who has had charge of the office affairs of the Company since 1898, has resigned in order to take a responsible situation on the staff of a large insurance corporation in New York.

The proprietors of the Clinton (Mass.) Gas Light Company, says the *Courant* of that place, have instituted a charge of $2 for putting in a meter in locations where meters had been discontinued, and the measurers were ordered reinstalled.

The Commercial Club of the Boston Consolidated Gas Company held its first concert and ball in Howe Hall, 17 Huntington street, Boston, the evening of Tuesday, the 2d inst. The Committee of Arrangements had a perplexing task it was thought, but to Messrs. Buffington, Kelly, Dempsey, *et. al.*, it was an open book. Everyone enjoyed the music and the mazes, and many shared both.

The Company at Fredonia, N. Y., is now operated by the Western New York Construction Company, the principals in which we understand are proposing to engage rather more extensively in the gas business than is the present case.

During the last week in March 100 students of the University of Ohio visited the plants of the Milwaukee (Wis.) Coke and Gas Company and those of the Milwaukee Gas Light Company. It is needless to say that their reception was cordial and that their interest in their inspecting was evident.

Mr. M. R. Cobb, the recently appointed Engineer of the Canandaigua (N. Y.) Gas Light Company, after a complete inspection of the plant, has determined that little short of rebuilding will meet its needs.

The topic for the last meeting of the Quiz Club, of the Rome (N. Y.) Gas, Electric Light and Power Company, was the gas cooker and how best to get it into the houses of the consumers. Superintendent Fields' contribution to the debate was a most illuminative one.

The incorporators at Harrisburg, Pa., of the New East Pennsboro Illuminating Gas Company, East Pennsboro, Pa., is reported. The initial capitalization is $5,000, the charter being so framed as to permit the extension thereof to any reasonable sum required for construction work.

Assemblyman Riordan has introduced a bill in the New Jersey Legislature which provides that in cities of the first class there shall be established a department for the supervision and inspection of gas and electrical equipments wherever situated, under the inspection and supervision of the several Boards of Health. This department is to have the control and direction of the placing, establishing and maintaining in buildings of all electrical and gas appliances. It is also provided that the several Boards of Aldermen shall appoint a practical electrician or gas engineer to have charge of the said departments at such salary as the Board shall fix, the tenure of office to last for one year. If this bill has not a rotten smell, we would like to know what sort of an odor it does carry?

At the annual meeting of the shareholders of the Western United Gas and Electric Company the Directors elected were: I. C. Copley, W. S. Beaupre, E. S. Hobbs, C. E. Colwell, R. N. Strohn, C. C. Smith, J. A. Mason and S. D. Seamans, of Aurora, Ills.; F. Bennett, Joliet, Ills.; John C. Lowry and M. W. Stroud, Philadelphia, Pa.

The main offices of the Worcester County (Mass.) Gas Company will shortly be removed from Spencer to Palmer. The Company has leased the old bank building in Palmer for a term of years, and will remodel the same to meet the requirements of a modern, up-to-date, rapidly growing corporation.

"Cincinnati is a smashing big city and has within its boundaries many imposing edifices which house the various staffs of many huge corporations, but you may say as positively as you like that no opening of any of those was attended with the eclat that marked the opening of the Cincinnati Gas and Electric Company's beautiful and capacious business headquarters at Fourth and Plum streets on the 25th ult. Thousands visited the premises, and it is hard to say whether the display was not outdone by the effulgent entertaining efforts of Mr. Theodore Clauss, Mr. Edward Miller, Mr. "Ben." Walmsley and Mrs. Deborah Coben. I tell you, it was great.—L. T."

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, APRIL 8, 1907.

The Market for Gas Securities.

The situation nominally has shown great improvement over that apparent last week, but quotations for Consolidated are still ridiculously low. The opening price to-day (Friday) was 126, and at noon the stock sold at 129. New Amsterdam 5's sold at auction at 95¾ and accrued interest. Five $1,000 bonds were thus disposed of. Brooklyn Union is 110 to 120.

Peoples, of Chicago, is 92⅛ to 92½, and Massachussetts gas is reported at 60¾ to 61. Cincinnati gas and electric has been quite heavily dealt in, with most of the transactions at 97½ to 98¼. The inquiry on bond account continues active.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

APRIL 8.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y City Companies	*Capital*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	129	129¼
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	4,000,000	1,000	101	104
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	..	105
Mutual	3,500,000	100	190	225
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	95	98
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p.ct.	1,000,000	.	98	104
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	101	103
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	108	111
Con 5's, due 1945, J. & J.	1,500,000	..	104	110
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
1st Mtg. 5's, due 1930, M. & N	1,500,000	1,000	104	108
The Brooklyn Union	15,000,000	1,000	110	120
1st Con. 5's, due 1948, M. & N	15,000,000		107	..
Yonkers	999,650	500	130	..
Out-of-Town Companies.				
Bay State	50,000,000	50	¼	⅜
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	500,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	9	10
" " Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co.	29,500,000	100	98	100
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	87	88
Preferred	3,026,500	100	107½	108
Consumers, Toronto	2,500,000	50	200	204
Consolidated, Baltimore	11,000,000	100	.	90
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
Bonds, 5's	10,500,000	..	107¼	108½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	35
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	05
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Massachusetts Gas Companies of Boston	25,000,000	100	60¾	61
Preferred	25,000,000	100	83	83½
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	6,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	92¾	92½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
" 2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104¼	105¼
San Francisco, Cal	15,800,000	100	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,500,000	20	292½	300
First mortgage 6's	600,000	..	..	..
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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., Mar. 13, 1907.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable April 15th, 1907, to stockholders of record at the close of business, Mar. 30, 1907. Checks will be mailed.

1658-4 LEWIS LILLIE, Treasurer.

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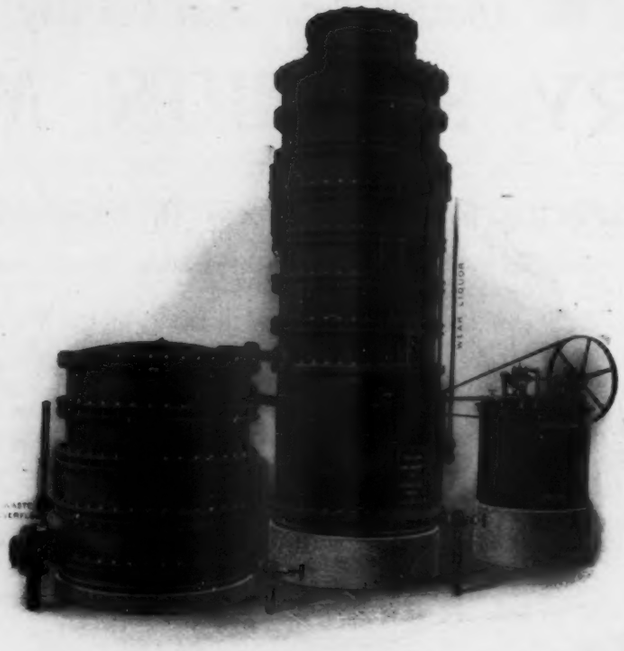

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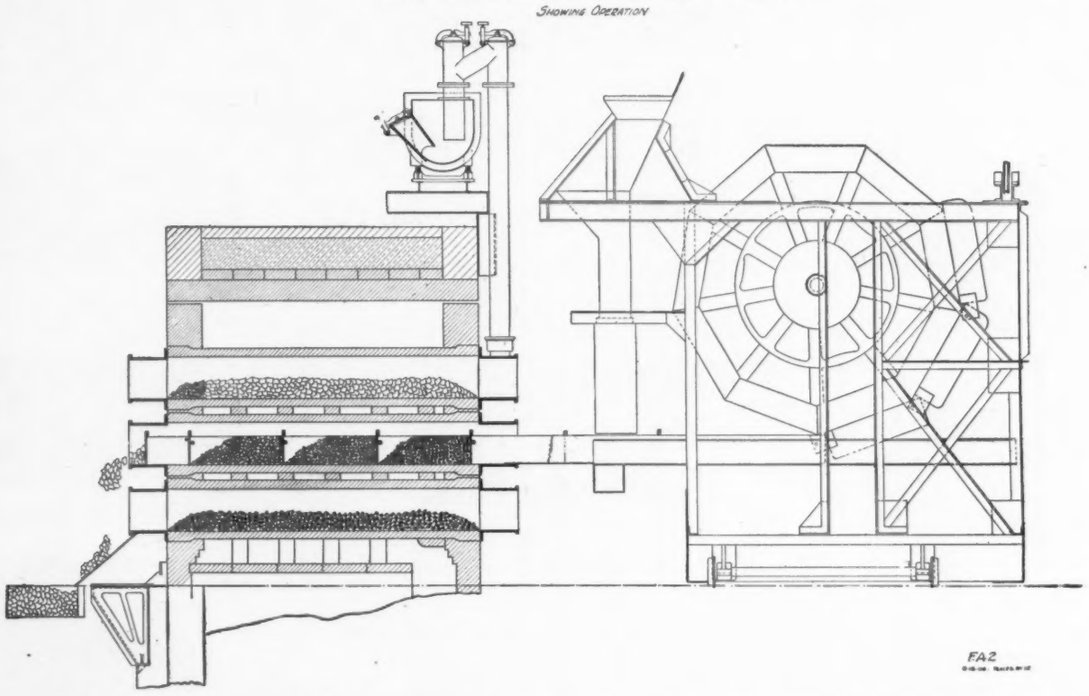

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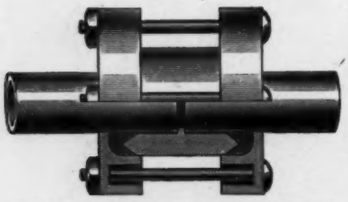
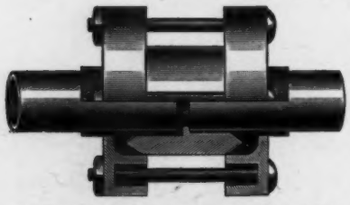
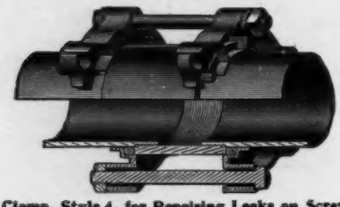


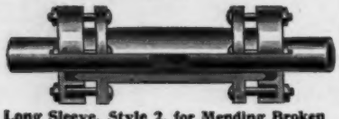
Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.



Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe,



Clamp, Style 4, for Repairing Leaks on Screw Collar.



Long Sleeve, Style 2, for Mending Broken Lines.

S. R. DRESSER MANUFACTURING CO.,

SUCCESSORS TO

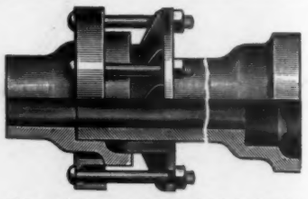
S. R. DRESSER,

BRADFORD, PA., U. S. A.,

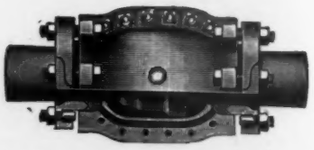
Patentee and Manufacturer of Specialties for Gas and Water Lines,

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

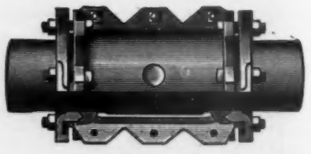
STATE REQUIREMENTS AND SEND FOR CATALOGUE.



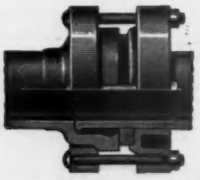
Coupling, Style 9, for Special Style Cast Iron Pipe.



Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.



Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.



Clamp, Style 4½, for Repairing Leaky Lead or Cement Joints in Cast Iron Pipe.

Two Light Arc.

Inverted Arcs.

Ramsdell

For outdoor or indoor use; made in five sizes---one-light to five-light. The "Ramsdell" is the only Inverted Arc manufactured. Everything about it is of the same high quality that has made the "Ramsdell" the standard among inverted lamps.

Gas Companies renting Arc Lamps to their customers will find this Inverted Arc gives vastly greater satisfaction than any other arc lamp on the market. And the cost of maintenance will be found to be much less.

It gives more and better light per cubic foot of gas than any gas lamp in the world.

Operated with chain-pull. In cases where local conditions require re-regulating this is easily accomplished, each burner having its individual regulator.

List prices range from $8.75 to $24.

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H. M. Byllesby & Company

(Incorporated),

GAS ENGINEERS,

DESIGN, CONSTRUCT AND OPERATE COMPLETE COAL, WATER AND CRUDE OIL GAS PLANTS.

HIGH AND LOW PRESSURE DISTRIBUTING SYSTEMS.

AMERICAN TRUST BUILDING,

CHICAGO.

NO. 16 MUELLER SWIVEL NO. 1.

Mueller Gas Tapping Machines.

C—1004.

If you find after you get this machine fastened to the pipe that the feed yoke interferes with the handle movement, you don't have to take the machine off and turn it around. The yoke is swiveled and can be adjusted to any angle necessary to get it out of the way. This machine makes taps from ⅜ to 2 inch in pipe from 2 inch to the largest.

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UNCONDITIONAL GUARANTEE

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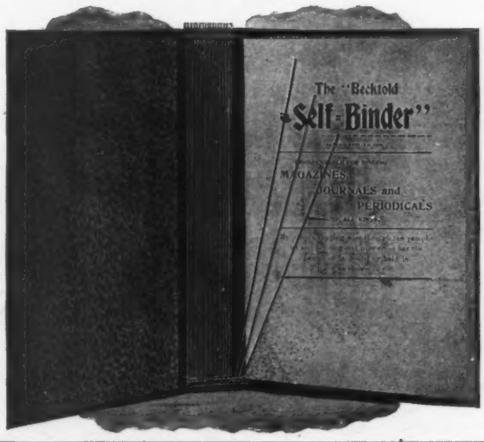
Decatur, Ill., U. S. A. New York, N. Y., U. S. A.

BINDER

FOR THE

JOURNAL.



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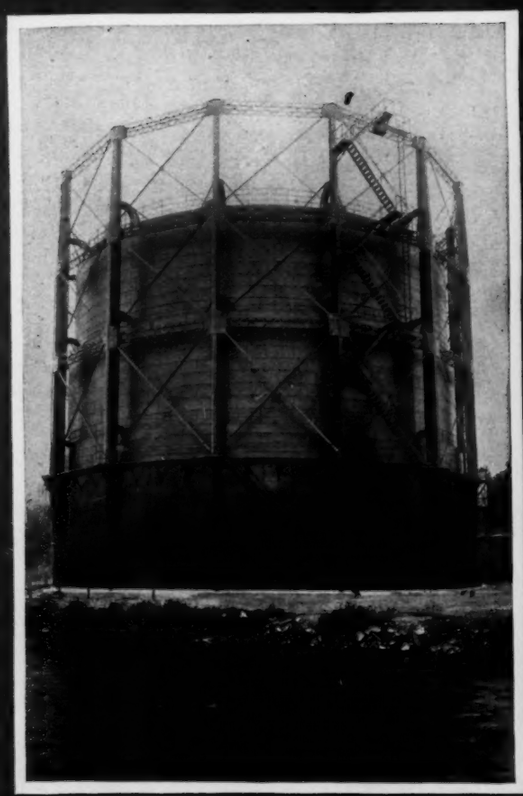

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CRUSE-KEMPER COMPANY

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TRIPLE
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WITH OR WITHOUT
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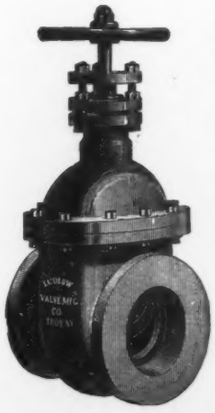
BRIDGE & OGDEN STREETS
NEWARK, N.J.
ESTABLISHED 1865



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Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY

Send for Catalogue.

This cut shows the Hunt Cable Car handling coke (cold) which has been quenched in the Mann chute.

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FOUNDED 1872.

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COAL and COKE HANDLING MACHINERY

AND THEIR APPURTENANCES, SUCH AS VALVES, SCREENS, etc.

Also "Industrial," Automatic and Cable Railways, including cars for unusual conditions.

Bristol's Recording Pressure Gauges

—(ALL RANGES).—

Used the World Over.

Necessary Equipment

Write for Catalogue A.

For Every Gas Plant.

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Chicago: 753 Monadnock Bldg.

The Bristol Co., Waterbury, Conn., U S.A.

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For several years associated with the late CAPTAIN WILLIAM HENRY WHITE,

WILL CONTINUE THE BUSINESS OF

CONSULTING ENGINEER

For Gas, Water and Electric Light Companies, at

No. 41 Wall Street, Room 1707, New York.

TELEPHONE, 5534 BROAD.

ESTABLISHED 1856.

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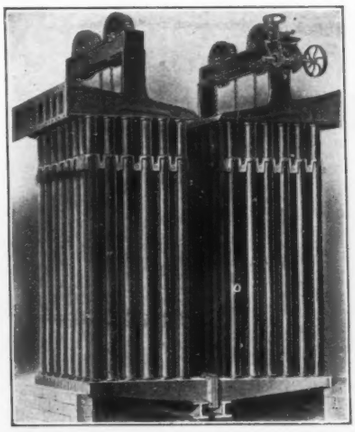
Manufacturers of

High Grade Firebrick, Blocks, Tiles,

ETC.,

Works: Maurer, N. J. Office: 420 E. 23d St., N. Y. City.



HOW MUCH COAL PER 1,000 CU. FT. OF WATER GAS?

If the process of making water gas were theoretically perfect, only 24 lbs. of coal would be consumed per 1,000 cu. ft. of gas generated. As a matter of fact, the actual figures are between 40 and 48 lbs. per 1,000 cu. ft. It is apparent that there is a waste somewhere, and if you will take the trouble to put a thermometer over the stack valve during the "blowing up" period, you will see where the heat goes to. From one-third to one-half of the heat escapes to the atmosphere, either as sensible heat or latent heat of combustion. If use can be found for this heat a great economy could be effected immediately.

We have found such a use. By means of the Green Air Heater 12 per cent. to 15 per cent. of this heat, or more, can be imparted to the air blown to the generator. This will reduce the time for blowing up and increase the temperature of the generator, so that about the same proportion of coal will be saved.

After the gases have passed through the air heater they are still hot enough to use in a Green Fuel Economizer to heat the boiler-feed water up to the evaporative point. In In this way a quarter of the boiler coal can be saved. In connection with a 6-ft. generator an investment of $3,500 in an Air Heater and an Economizer will save from $2,300 to $2,500 per year. This ought to repay you for the trouble of writing us for further information. Ask for Circular "AG."

THE GREEN FUEL ECONOMIZER CO.,
MATTEAWAN, N. Y.

(Sole builders of the Green Fuel Economizer in this country; we also build Fans and Blowers.)

FOR HOT BATHS,

And for every other Hot Water Need, use the

IMPROVED

HUMPHREY CRESCENT INSTANTANEOUS WATER HEATERS.

Efficient. Compact. Durable. Every Heater Guaranteed.

No. Heaters.	Price.	Gas Supply from Meter.	Heats Gals. per Min. 50° in Temperature.	Height.	Diameter.	Shipping Weight.
Non-Contact.. 2	$40.00	¾ Inch.	2½	34⅝ Inches.	12 Inches.	70 Pounds.
Contact..... 6	29.00	¾ "	3	29½ "	12 "	60 "
" 8	23.50	1 "	2½	28½ "	10¾ "	48 "

These prices include Safety Valves and Unions, one Bent Output Spout. For prices of fittings see our complete catalogue, "The Luxury of a Bath."

We will be glad to quote Discounts.

HUMPHREY CO., · · · Kalamazoo, Mich.

The ONLY manufacturers in the world of a complete line of Instantaneous Water Heaters.

LLOYD'S SUBMERSION WASHERS.

Maximum Efficiency,
Minimum Back Pressure,
Complete Safety.

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WHY DO GAS EXHAUSTERS

AND HIGH PRESSURE GAS PUMPS BUILT BY

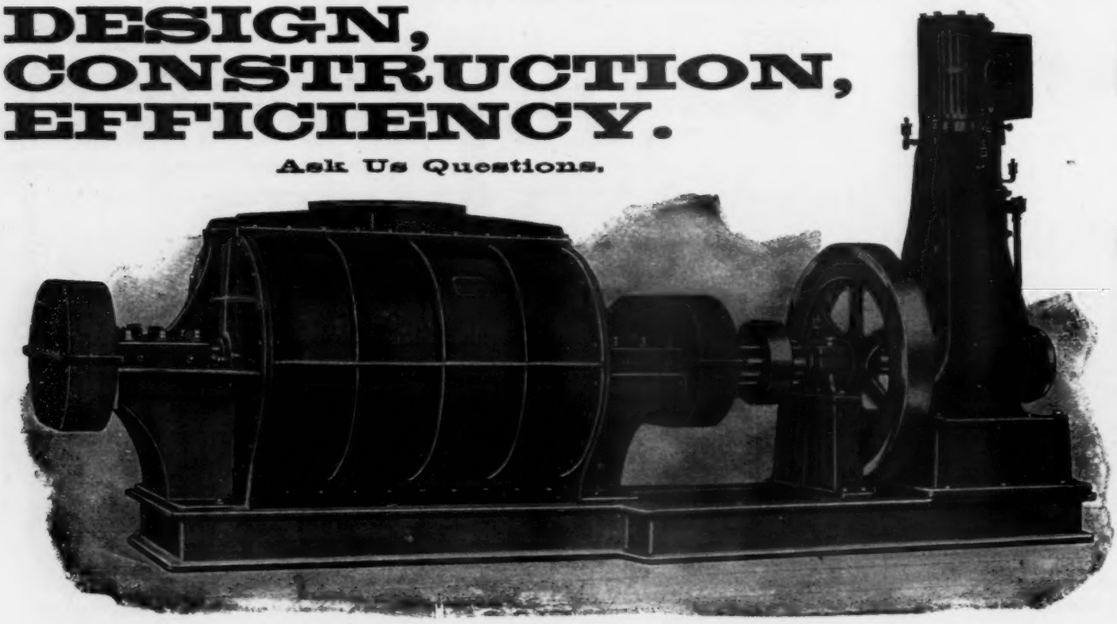
THE CONNERSVILLE BLOWER CO.

Stand so High in the estimation of those using them?

THE ANSWER IS IN THREE WORDS:

DESIGN, CONSTRUCTION, EFFICIENCY.

Ask Us Questions.



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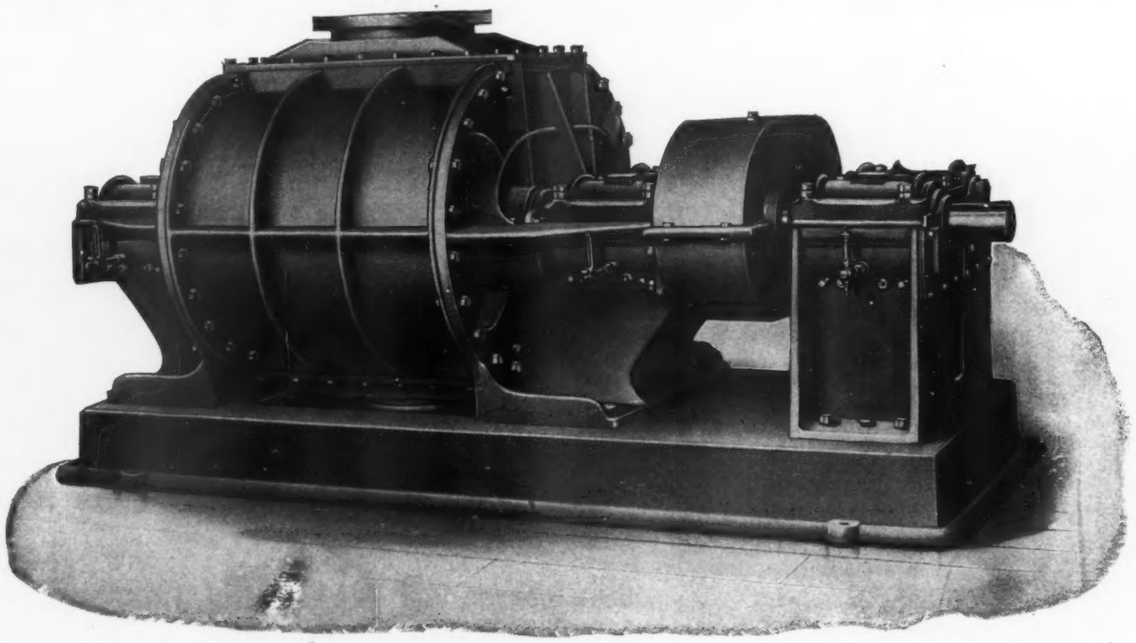
Eastern Sales Agent:
HORACE G. COOKE,
95 Liberty Street,
New York City.

Write us about our Improved Stuffing Boxes.

Something Entirely New.

ROOTS' EXHAUSTERS for HIGH and LOW PRESSURE WORK.

The highest efficiencies obtained. Most perfect devices for adjustment and maintenance of proper alignment. Use our flexible coupling to correct troubles caused by misalignment and engine shaft thrust. Our gas governor is the best. By-pass, gas valves and fittings.



P. H. & F. M. ROOTS COMPANY,

HOME OFFICE: Connersville, Ind. NEW YORK OFFICE: 120-122 Liberty St. CHICAGO OFFICE: 1547 Marquette Bldg.

THE HUMPHREY GAS ARC
YOUR BEST Salesman
ARC LAMPS
WORK IN THE OPEN.
Show the public that there's an enterprising Gas Company in town.
Help all branches of the business.

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MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

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Globe Street and Boulevard Lamps.

Cheapest and Best

THOUSANDS IN USE WITH INCANDESCENT BURNERS.

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Plans prepared and Estimates furnished at short notice.

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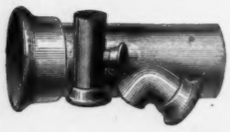


CAST IRON WATER AND GAS PIPE,

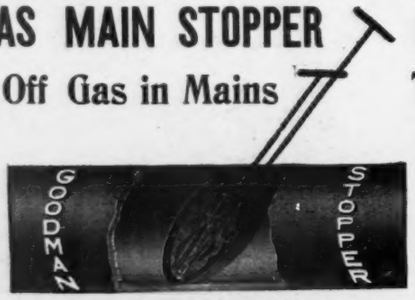
FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :



Temporarily during alterations and repairs. : : : :

STOPPERS SENT ON TRIAL.

Address: SAFETY GAS MAIN STOPPER CO., 552 E. 135th St., New York City.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

Practical Handbook on

GAS ENGINES,

With Instructions for Care and Working of the Same,

By G. LIECKFELD, C.E.

Translated with Permission of the Author, By GEO. M. RICHMOND, M.E.

Price, $1. For Sale by
A. M. CALLENDER & CO.,
No. 42 Pine Street, - - New York City.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50.
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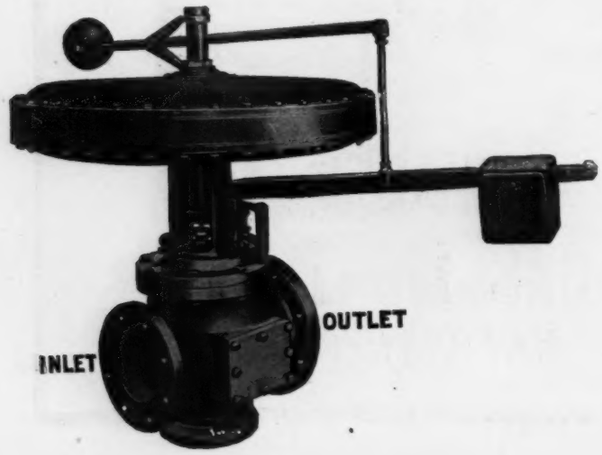

THE FULTON GAS PRESSURE GOVERNOR,

WITH AUTOMATIC SAFETY CUTOFF.

For Artificial or Natural Gas.
For District or Service Use.

Our DUPLEX SENSITIVE GOVERNOR, with Automatic Cutoff for district service, will reduce high pressure gas to inches of water without variation.

Absolutely safe and reliable. No complicated mechanism to get out of order. More than 20 years' experience with the largest gas companies.

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AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

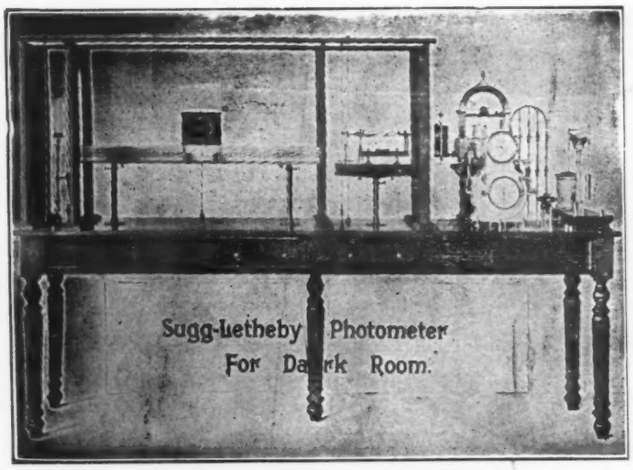
APRIL, 1907.

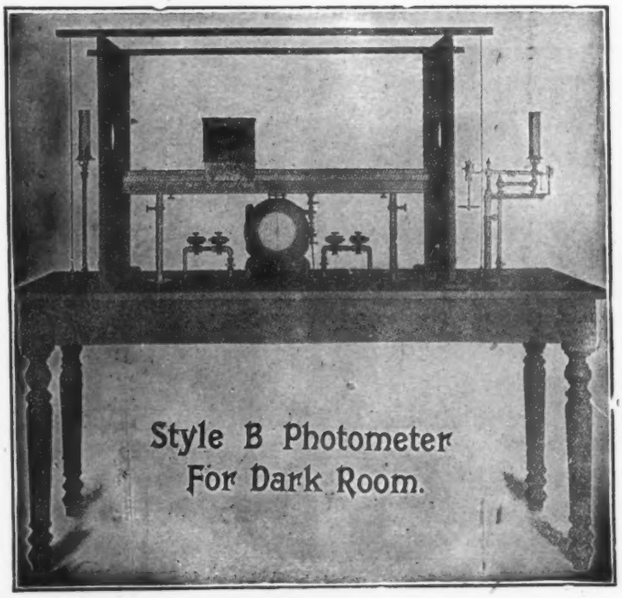
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Mon.	1	6.50 PM	10.50 PM
Tue.	2	6.50	12.00
Wed.	3	6.50	1.00 AM
Thu.	4	6.50	2.10
Fri.	5	6.50 LQ	3.00
Sat.	6	6.50	3.50
Sun	7	7.00	4.30
Mon.	8	7.00	4.30
Tue.	9	7.00	4.30
Wed.	10	7.00	4.30
Thu.	11	7.00	4.30
Fri.	12	7.00 NM	4.30
Sat.	13	7.00	4.30
Sun.	14	7.10	4.20
Mon.	15	7.10	4.20
Tue.	16	7.10	4.20
Wed.	17	10.20	4.20
Thu.	18	11.20	4.20
Fri.	19	12.00	4.20
Sat.	20	12.50 AM FQ	4.20
Sun.	21	1.20	4.10
Mon.	22	2.00	4.10
Tue.	23	2.30	4.10
Wed.	24	3.00	4.10
Thu.	25	3.30	4.10
Fri.	26	No L.	No L.
Sat.	27	No L FM	No L.
Sun.	28	No L.	No L.
Mon.	29	7.20 PM	9.40 PM
Tue.	30	7.20	10.50

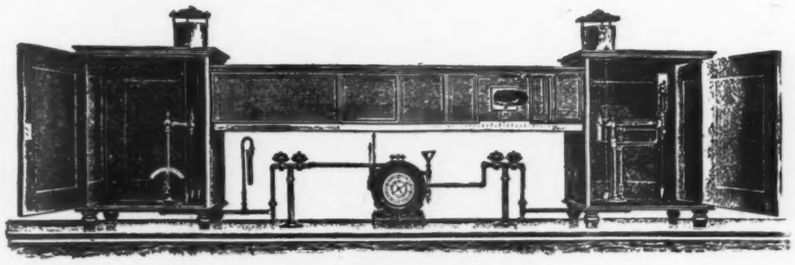
TOTAL HOURS DURING 1907.

By Table No. 1.

	Hrs.Min.
January	211.10
February	193.40
March	182.10
April	167.00
May	157.00
June	145.30
July	151.50
August	162.30
September	175.30
October	202.40
November	209.30
December	231.50
Total, yr.	2190.20







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

APRIL, 1907.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. All Night Lighting. Light.	Extinguish.
		P. M.	A.M.
Mon.	1	6.10	4.55
Tue.	2	6.15	4.40
Wed.	3	6.15	4.40
Thu.	4	6.15	4.40
Fri.	5	6.15	4.40
Sat.	6	6.15	4.40
Sun.	7	6.15	4.40
Mon.	8	6.15	4.40
Tue.	9	6.25	4.30
Wed.	10	6.25	4.30
Thu.	11	6.25	4.30
Fri.	12	6.25	4.30
Sat.	13	6.25	4.30
Sun.	14	6.25	4.20
Mon.	15	6.25	4.30
Tue.	16	6.30	4.20
Wed.	17	6.30	4.20
Thu.	18	6.30	4.20
Fri.	19	6.30	4.20
Sat.	20	6.30	4.20
Sun.	21	6.30	4.20
Mon.	22	6.30	4.20
Tue.	23	6.40	4.10
Wed.	24	6.40	4.10
Thu.	25	6.40	4.10
Fri.	26	6.40	4.10
Sat.	27	6.40	4.10
Sun.	28	6.40	4.10
Mon.	29	6.40	4.10
Tue.	30	6.45	4.00

TOTAL HOURS DURING 1907.

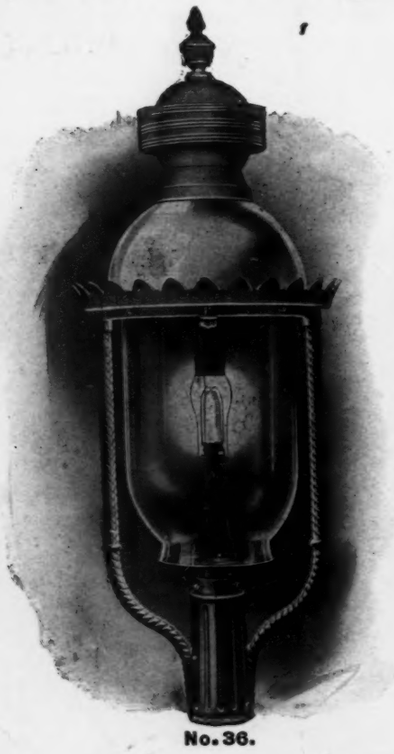
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street.
BOSTON, 820 Beacon Building.
PHILADELPHIA, Broad and Arch Streets.
ST. LOUIS, 712 Roe Building.
CHICAGO, 218 La Salle Street.
SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY

....OF AMERICA....



No. 36.

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

INVERTED REFLEX GAS LIGHT
TRADE MARK

Succeeds and Excels the Electric Light at One-Quarter the Cost.

THE BURNER.

Elegance of Appearance.
Best Possible Material and Workmanship.
Perfect Combustion.
Lowest Gas Consumption.
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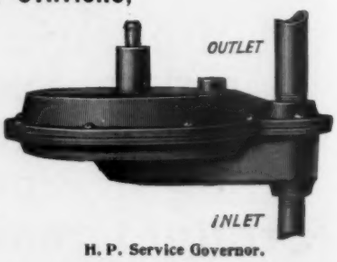

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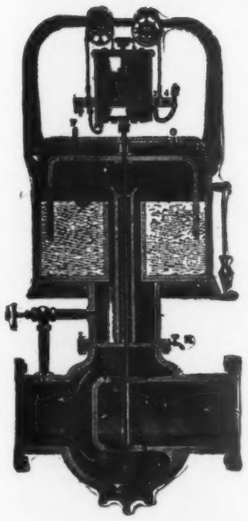

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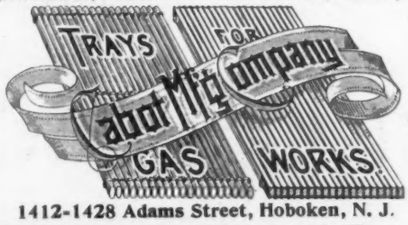

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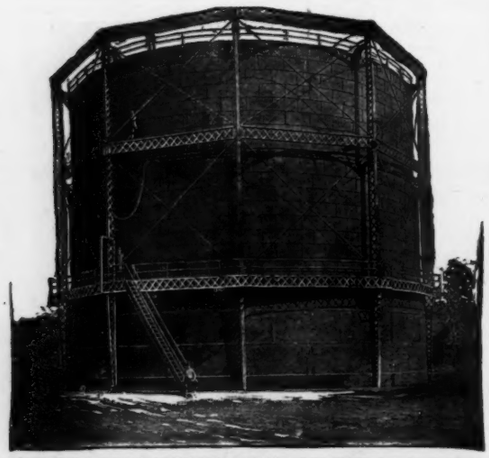

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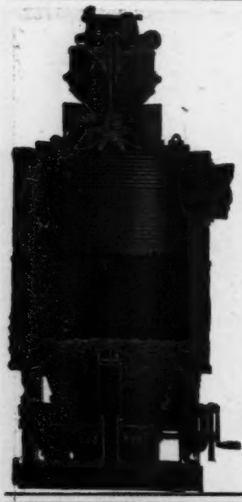

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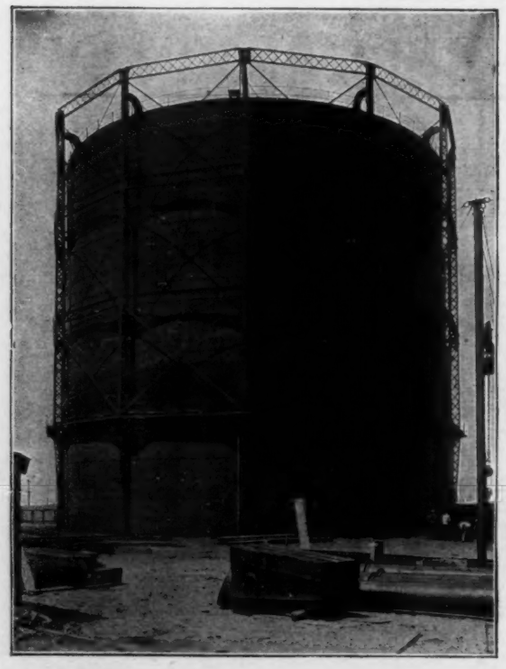

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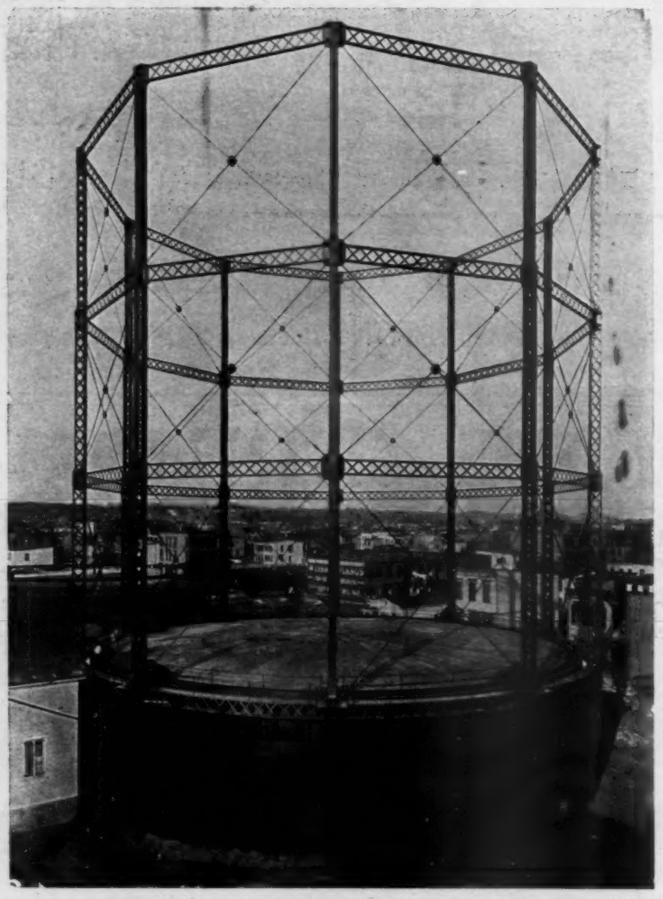

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